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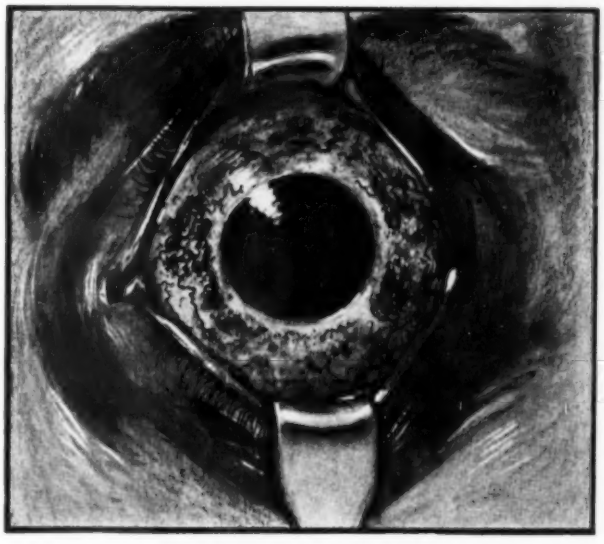

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CASES OF W. B. DOHERTY

AMERICAN JOURNAL OF OPHTHALMOLOGY

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CASES OF MELANOSIS OCULI, WITH MICROSCOPIC FINDINGS.

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NEW YORK CITY.

Of the four cases here reported one occurred in a negro and the eye was glaucomatous when first seen. It was enucleated and the distribution of pigment studied with the microscope. Melanosis is usually unilateral and many previously reported cases have finally ended in melanosarcoma.

Melanosis oculi is the opposite of albinism, and may be defined as excessive pigmentation, in mesoblastic tissue encircling the secondary optic vesicle in its outer layer. It is, of course, essentially a congenital defect, and the pigmentation may effect any structure of the eyeball and its appendages.

The very high percentage of cases of melanosis bulbi which later develop melanosarcoma, is very striking (29 per cent); the malignant tumor occurring either in the melanotic spot, or at a remote distance from it. Most pigmented spots should be removed if this procedure can be easily carried out; and all melanomata gradually enlarging, with a marked vascular supply, should be looked upon as extremely dangerous growths, capable of rapid malignant degeneration.

Melanosis oculi may occur in brunettes, blondes and in the negro. I have found no record of any case occurring in the negro; but I am reporting one of the most interesting and marked cases of melanosis oculi that I have been able to find in ophthalmic literature, and will also present the unusual microscopic sections.

A review of the literature rapidly impresses one with the fascination of this subject. It is not the purpose of this paper to go into any lengthy detail, nevertheless, I shall mention a most unusual case described by Dr. J. Oeller in his Atlas of rare ophthalmoscopic conditions, published in 1903. He calls the fundus picture melanosis vasculorum retinae, and goes into a very interesting discussion as to the cause of the marked pigmentation of the vessels, appearing in the fundus as black cords. Whether this is a true case of melanosis has not been ascertained. I quote this case to impress the fact that no structure of the eye is immune from this rather unusual condition. I report the four following cases:

CASE 1. G. P., a negro, 29 years of age, was first seen by me in November, 1924. Seven months previously, he complained of a gradual diminution of vision in the right eye, and finally blindness with intense pain developed. There was no previous history of illness, except the ordinary diseases of childhood, and I was not able to trace any history of malignancy in his family. A general physical examination was negative, with the exception of the right eye, its appendages, and the right side of the face.

The skin of the forehead, upper lid, right side of the nose and cheek presented a peppered appearance, having numerous small, round, black pigmented spots, closely situated, and not unlike powder burns. The spots varied in size, but none were larger than one quarter of an inch in diameter. There were no other deposits of pigment on the rest of his body. He said this condition had existed since birth, and that so far as he knew there has been no increase in the size and number of the pigmented spots. A prominent dermatologist made a diagnosis of a benign congenital pigmentation of the skin, and was emphatic that xeroderma pigmentosa could be ruled out.

The ocular conjunctiva presented stellate shaped islands of pigment, scattered over the surface; while shin-

ing thru the conjunctiva at the sclerocorneal margin was a densely dotted zone of pigmentation. In the region of the ciliary body, on the nasal side at two o'clock there was a ciliary staphyloma, about three-eighths of an inch in diameter.

Fig. 1.—Enucleated globe showing pigmentation of sclera and ciliary zone.

The cornea was hazy but no evidence of pigmentation could be made out. There was a marked circumcorneal injection; the pupil was semidilated and failed to react to both light and accommodation; the iris appeared thickened and darker than its fellow of the opposite side. Further details could not be detected due to the haziness of the cornea. There was no fundus reflex; the tonometer registered 57, and a pupillary reflex could not be discerned by transillumination. The patient complained of great pain and enucleation was advised.

EXAMINATION OF GLOBE.

Macroscopically. The globe registered in the horizontal meridian 28 mm. and in the vertical meridian 30 mm. The antero-posterior diameter 30 mm. The vertical meridian of the cornea was 15 mm. while the horizontal was 17½ mm. The external surface of the sclera showed marked pigmentation; its anterior third presented a diffuse collar of pigment, with overlying accentuated round black areas of pigment; the middle third of the globe was rather free, while the posterior third showed isolated, black, hand shaped blotches. When the globe was divided the vitreous was found to be liquid, and filled with a fluid that had the appearance of ink. The retina was detached and there was a marked cyclitic membrane present. In the ciliary region, on the nasal side, at two o'clock there was a marked staphyloma, containing a substance slightly gelatinous in character and deeply pigmented. Unfortunately the microscopic examination of the fluid vitreous was not made.

Microscopically. The epithelial layer of the cornea was not normal; its anterior layer showed some cell changes, while the basal cell layer presented evi-

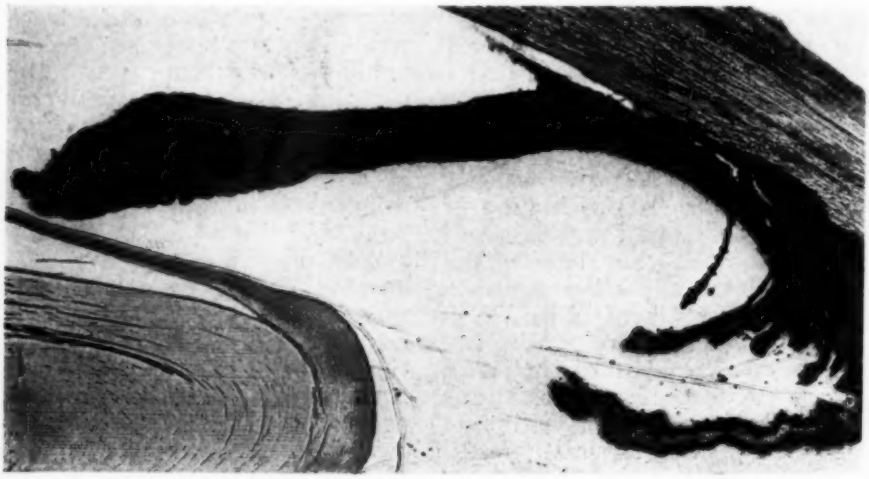

Fig. 2.—Pigmentation of iris and ciliary body, obliteration of the filtration angle with peripheral synechiae, and normal contour of iris.

dences of pigmentation. In the center of the cornea, and towards the periphery at the sclerocorneal margin, the pigmentation was diffusely distributed. At the sulcus on the nasal side there was a marked hyperemia with distinct evidence of perivasculitis, while on the temporal side in this situation the condition was not as well marked.

Bowman's membrane was normal and intact. In the substantia propria the corneal lamellae were a little off axis, and there were quite a few wandering cells present. Descemet's membrane was normal; the endothelial layer in places was cut on the bias giving the appearance of several layers of thickness. Adhering to it were some pigment granules and red blood cells. The anterior chamber was not shallow. At the angle of the anterior chamber there was a marked annular synechia, which had caused considerable shortening of the iris, very marked on the temporal side.

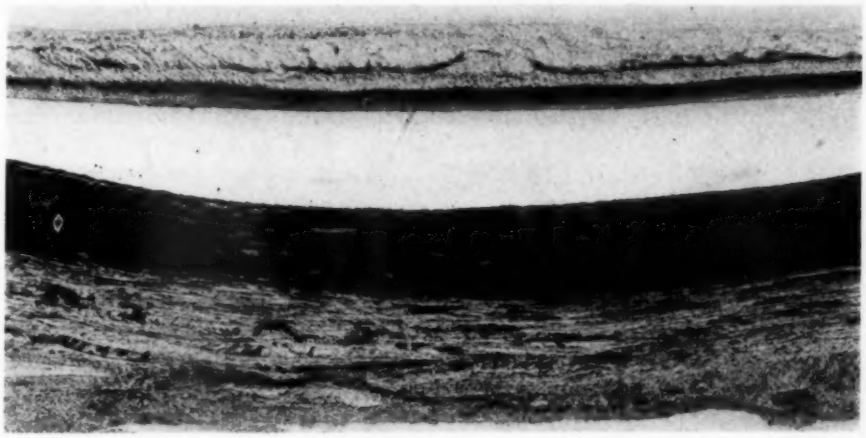

Fig. 3.—Pigmentation of choroid, compression of vessels, and patches of pigment in sclera. The normal contour of the uveal tract is retained.

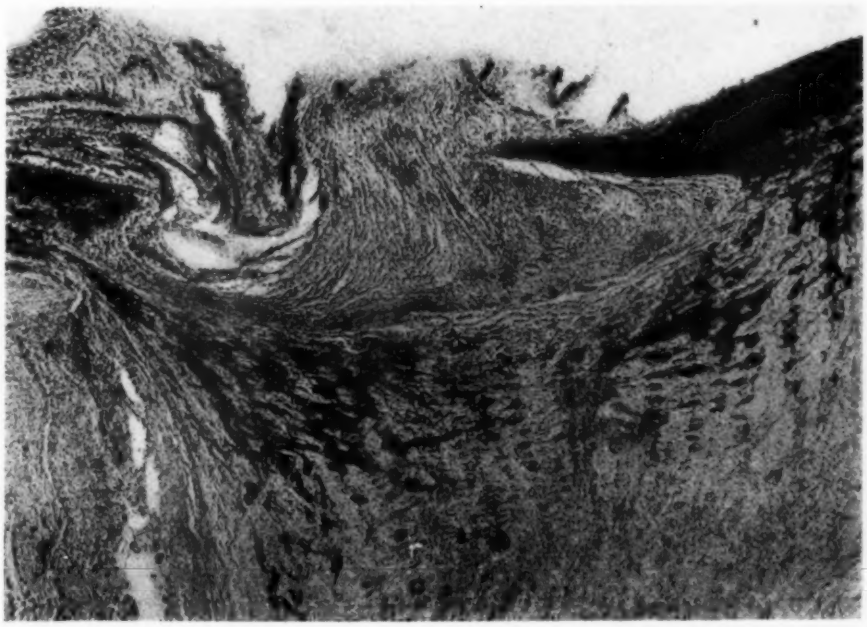

Fig. 4.—Glaucomatous disc, pigmentation of cribriform fascia and pigment extending into the nerve.

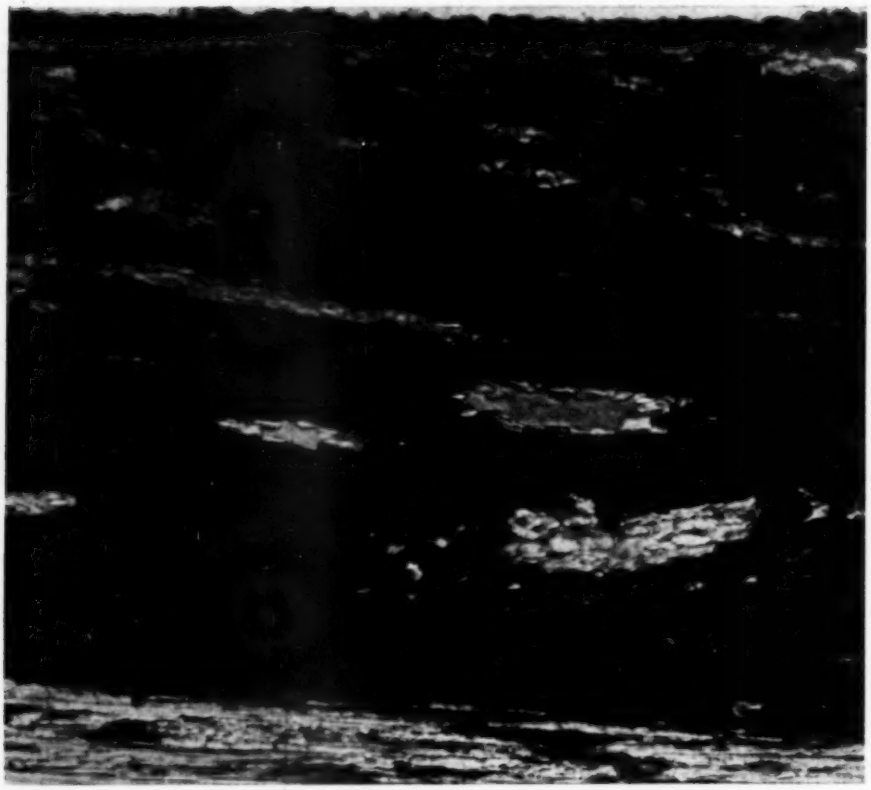

Fig. 5.—High power shows pigmentation of choroid, flattening of vessels and pigmentation of sclera.

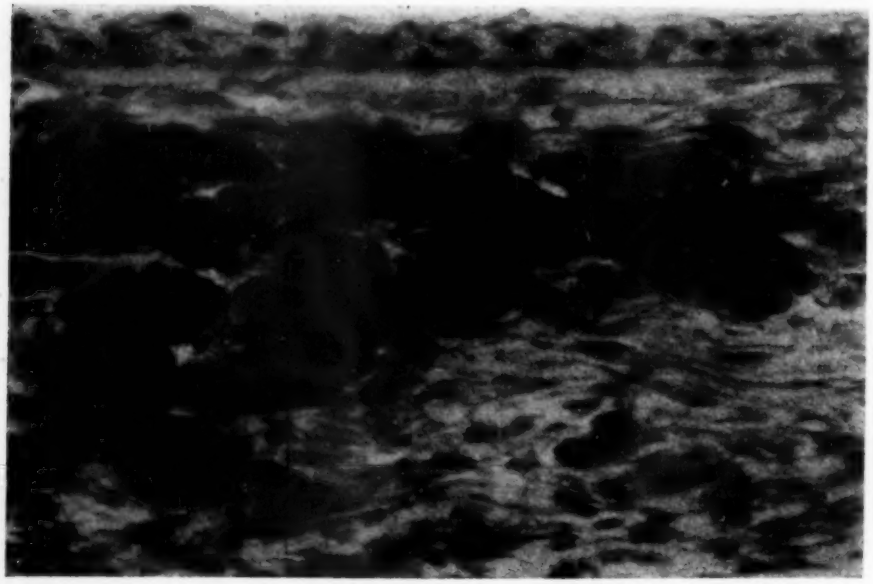

Fig. 6.—High power. Depigmented section of Fig. 5 showing chromatophores.

The spaces of Fontana and canal of Schlemm were completely obliterated by a packed and diffuse infiltration of pigment.

The iris showed marked atrophic changes, with absence of its crypts and furrows. Its stroma was so densely packed with pigment that the details of the structure could not be made out; the retinal pigment layer extended over its pupillary margin for quite a little distance. On the temporal side these atrophic changes were especially marked. The ciliary muscle was so densely packed with pigment that its fibers could not be demonstrated. On the nasal side of this region there was a staphylomatous bulging. The ciliary processes showed marked atrophic changes, were pushed forward and were densely pigmented.

The lens contained a number of nuclear changes. On its posterior surface there was a cyclitic membrane, extending from the ciliary processes. In the membrane there were red blood cells, leucocytes and pigment. These leucocytes showed marked chemotactic activity for the pigment. The retina presented marked inflammatory changes and was completely detached. The rod and cone layer had cystic changes present. There was a migration of the retinal pigment, as far forward as the limitans interna. A number of small hemorrhages were present in the ganglion cell and nuclear layers. Cystic spaces were present, running from the ganglion cell layer to the outer nuclear layer. The vitreous contained a number of organized hemorrhages.

Fig. 7.—Case 2. Left eye and adjoining parts of face.

The choroid was so densely pigmented that only in scattered places could blood vessels be seen. They had slit like, or compact appearance, with their corpuscular contents completely shown. In the depigmented slide we found the vessels very thin walled, and in places the walls were absent. The stroma contained densely packed round and spindle shaped cells, which extended thruout the uveal tract; but this membrane showed no irregularity in its contour, in spite of this dense infiltration of pigment and cells.

In the sclera the pigment between its lamellae was irregularly distributed,

from its inner to outer border, from the sclerocorneal margin to the lamina cribrosa, where it was extremely densely marked, extending down between the axis cylinders of the optic nerve. The disc showed a marked glaucomatous cupping, which was filled with inflammatory tissue. This tissue extended forward, and appeared to be attached to the retina at the disc margin, and projected somewhat into the vitreous. In this tissue there were found new formed connective tissue cells, pigment granules and small blood vessels, the condition resembling retinitis proliferans.

Fig. 8.—Profile of Case 2, from left side.

The left eye was normal in all respects, with a very low error of refraction consisting of hyperopic astigmatism.

Case 2. Mrs. G. P. (see illustration) age 48, white and brunette. This patient consulted me in regard to an error of refraction, which consisted of a moderate amount of myopic astigmatism. The vision in both eyes with her appropriate lenses was normal; the clinical history negative. Her attention being called to the pigmentation of the left eye and skin of the face, she said that the condition of the eye had not changed since birth, but that the spots on the face seemed to be slowly increasing.

The colored illustrations, Plate 1, needs no description, but I wish to call special attention to the marked diffuse pigmentation of the iris, of the left eye, in comparison to that of the right. The slit lamp showed a very decided thickening of the pigment layers of the iris, but the stroma itself seemed to contain about the same amount of pigment as its fellow of the opposite side. The fundi of both eyes were normal in all respects, had no excessive pigmentation at any place and were of the same intensity of color.

Case 3. Mrs. B., age 42, blonde. The condition was similar to Case 2, with the exception of no pigmentation of the skin, the pigmentation existing only in the conjunctiva of the right eye, around the sclerocorneal margin, and arranged in light chocolate colored blotches. Her error of refraction was a moderate amount of hyperopia and hyperopic astigmatism. Vision was normal in each eye; the fundi the same in color and contained no pigmentation. The right iris was similar in all respects to the description of the left iris in the preceding case, appearing darker in color and more densely pigmented than the left iris.

Case 4. Mrs. T. S. Very marked brunette, age 31. Patient first consulted me regarding an infection of both eyebrows, following the removal of some lashes. She had paid no attention to the melanotic spot located on the conjunctiva of the right eye, which had existed from birth and, which she admitted, seemed to be getting larger for the past two months. The growth was situated about 4 mm. from the sclerocorneal margin, on the temporal side of the eye, in the normal line of the palpebral aperture. It measured 4 mm. by 3 mm., was rather markedly raised and well supplied by an artery, which came from a point near the external canthus and broke up into three branches before entering the melanotic spot. The slit lamp showed a growth richly pigmented and containing numerous branching fine blood vessels. In addition to this pigmentation a very interesting picture is well shown in the colored illustration of

this case, Fig. 2, Plate 1, of the bud like brownish black pigmentation and plaques of pigment, at the ends of the anterior ciliary vessels, around the entire ciliary zone, in both eyes. This patient had also a rather large mole, about 1 inch from the external canthus of the left eye, literally loaded with pigment. A similar mole was situated near the angle of the mouth on the same side of the face. I explained the danger of the melanoma on the conjunctiva, and she readily agreed to have it removed.

main cells do not resemble epithelial cells. They appear to be situated in a meshwork of delicate connective tissue. The nests of cells exhibit no tendency to infiltrate the adjoining stroma."

Diagnosis. Nevus of palpebral conjunctiva. Tendency to malignancy to be borne in mind.

Conclusions. Melanosis oculi may occur in either Caucasian or Negro race. Blondes and brunettes are both affected, the greater frequency being in brunettes. It is usually unilateral.

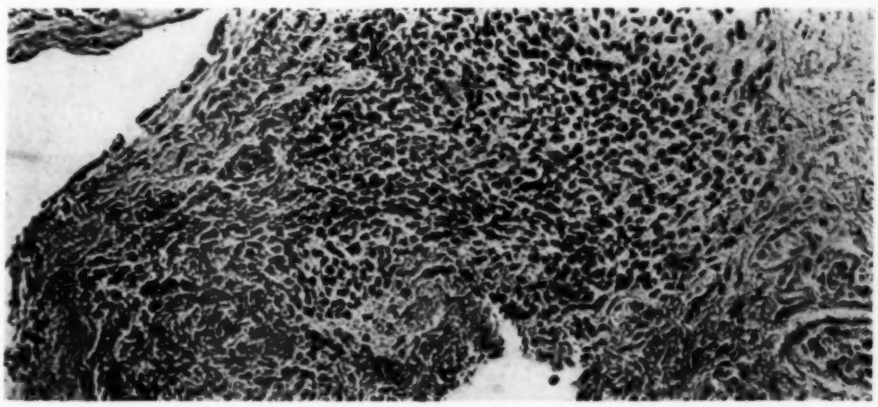

Fig. 9.—Section of pigmented growth showing nest like arrangement of cells.

Microscopic report of specimen, by Dr. Samuels and Mr. Burchell of the New York Eye and Ear Infirmary, was as follows. "The specimen is covered with stratified pavement epithelium. Embedded in the subepithelial stroma are many confluent nests of cells. They are mostly elongated showing but moderate variation in size and shape. They fail to present any considerable number of mitoses. The superficial area of these nests of cells presents collections of brown pigment granules, rather intracellular. The

Twenty-nine per cent of the cases reported have developed melanosarcoma. The pigmentation may involve any structure of the eye or its appendages. The globe may be destroyed by blocking of the filtration angle producing secondary glaucoma.

I wish to thank Mr. Edwin Burchell of the New York Eye and Ear Infirmary for his kindness in preparing the beautiful slides, and also Drs. Fuchs, Verhoeff and A. B. Reese for their interest shown in my cases.

150 *W.* 55*th St.*

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IVORY IMPLANT AFTER ENUCLEATION.

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To secure a better cosmetic effect Mules after evisceration implanted a glass globe in the scleral cavity. Frost and Lang placed the glass ball in Tenon's capsule after enucleation. Since then gold, silver, celluloid, sponge, peat, rubber, wire, paraffin, fat, bone and cartilage have been used. A brief outline is given of the use of these substances and the disadvantages attaching to each of them. For a similar purpose in general plastic surgery ivory has been used. A case is reported in which it was implanted in Tenon's capsule and appeared satisfactorily to meet the requirements of the use.

Since 1885, when Mules introduced the glass ball into the scleral cavity, many ophthalmologists have considered the problem of securing the best cosmetic results after enucleation. Sometimes a patient is seen whose eye was removed many years previously, even in early childhood, whose artificial eye looks natural in a well developed orbit. On the other hand, persons are seen with smaller sockets, folding in of the lids, and wearing glass eyes quite defective as to size and movements.

To obviate these faults, Frost and Lang[1] independently planted the glass ball into Tenon's capsule, two years after Mules' operation. Other ophthalmologists have followed this with the trial of different substances such as gold, silver, celluloid, sponge, peat, rubber, wire, etc. All these protheses have a strong tendency to extricate themselves sooner or later, and some have additional disadvantages, such as the possibility of the breaking of the glass, which is most extensively employed, and the weight and cost of the precious metals; and the inflammatory reaction which other inorganic substances may cause, immediately following the operation, or some time after.

Paraffin, which held sway for a short time in cosmetic surgery after its introduction by Gersuny[2], was used in enucleation by Spratt[3] in 1905, in 23 cases with one failure; and more recently by Dupuy-Dutemps[4] with seven failures in 24 cases. It is nonirritating and nonabsorbable; but its use has been condemned by Beck[5], as it may cause a secondary diffusion, as Kolle[6] terms it, or an extension of the mass beyond the place implanted. Harmon Smith[7] and Beard[8] also claim that the mass of paraffin when not extruded may change location.

Organic substances or living tissues, such as tendon or muscle, fascia or fat, when autogenic in origin, or taken from animals (as when the eyes of pigs or rabbits are used by Chilbert and Rohmer[9]) undergo absorption and in course of time leave only an insignificant trace.

Bone has recently been used and some claim with success. Hansen[10] reported 53 cases, operated on with two failures, in which he used autoplastic implantation of the head of the fibula. But from experiments carried out by John Staige Davis[11] and clinical observations by Ferris Smith[12], Sheehan[13], and others, it has been found that free bone, whether implanted with or without periosteum, is invariably absorbed.

Cartilage, however, has been found by the same experimentors to remain in situ without shrinkage, several years after implantation. Dr. Cecil Bagley, in a paper read before the Medical and Chirurgical Faculty of Maryland (April, 1926), stated that for several months costal cartilage, autogenic in origin, has been used after enucleation at the Wilmer Institute. This substance was used by Sattler[14] in 1912, and by Carlotti and Bailleul[15] in 1914, and by J. S. Aymand[16] during the World War. There is what Magitot calls a "sort of biologic law" that all free grafts, with the possible exception of skin, die; and consequently they act as dead inserts. Large groups of animal cells are able to live for a time, when separated from all connection with their vascular and nervous supply; but usually they die, since nourishment cannot reach the center by imbibition. Osteoclasts break down and

absorb the proteid matter, leaving an organic carcass, for the osteoblasts to restore with new bone, and cartilage. Magitot[17] tried cartilage after enucleation and found that it was absorbed after several months. Cohen[18] and Selfridge[19] have found it to be absorbed to a greater or less degree. The writer has seen it absorbed when grafted in nasal deformity. A further objection to cartilage is the necessity of an accessory major operation, with prolonged confinement to bed and exposure to complications; should the graft be absorbed or infected the operation would be in vain. Furthermore, cartilage with perichondrium has a tendency to curl at the edges, due to the shrinking of the perichondrium; and this might interfere with wearing an artificial eye; also the mass of cartilage needed is not always easily available.

Magitot[17] therefore uses cartilage taken from a young ox and placed in 20 per cent formalin for a week, then in sterile water ready for use. When needed he sterilizes it by steam and shapes it as desired. This substance has found many advocates. Dymling reports 66 cases with excellent results; Lyle[20], Doherty[21], Pandelescu[22] and others report success.

Dupuy-Dutemps[4] reports 20 cases of implantation of formalized rib cartilage of calf, according to Magitot, of which four were lost. Examination at the end of from one to three years showed that the cartilage had not been absorbed but that the artificial eye appeared sunken. He therefore implanted a sterilized sphere of paraffin (diameter, 18 mm., melting point, 60° C.) in 24 cases; in seven of these it was extruded, but in the others the eye did not appear sunken after from fifteen to eighteen months.

But formalized cartilage has not given universal satisfaction. I have substituted ivory, which some observers claim to be superior to any other substance, in other branches of surgery. Ivory has been used in plastic surgery by Mauclaire[23] since 1916, by Gluck[24] in bridging over long bone, and by Joseph[25] of Berlin in rhinoplasty since 1918 with uniformly good results. Ivory closely resembles human bone; and, being of a much higher calcium and inorganic content than cartilage, makes a better prothesis.

Microscopically,[26] true elephant tusk reveals a dense tubular structure, and across these tubes pass fine filaments of protoplasmic substance taking their origin in the central pulp of the tusk. These tubes are extremely fine, with a maximum diameter of 1/1000 inch. Ivory is very easily obtained, is not costly, and can be shaped without difficulty. It is well tolerated by the surrounding tissues and causes no inflammation or irritation; it is not absorbable and a thick capsule forms around it. This capsule can be demonstrated by X-ray very soon after the operation. The writer, having used ivory in rhinoplasty with success, lately had an opportunity to try it following an enucleation of a degenerated eye in a boy three years of age.

The procedure was carried out as follows: The operative field was sterilized with mercurochrome.[27] The conjunctiva and Tenon's capsule were opened and the recti muscles exposed, according to Agnew; a loop of chromasized catgut 00 was inserted incorporating a small bite of the capsule on each side of the muscle close to the tendon. Two loop sutures were thus placed in each straight muscle. All the muscle tendons were then cut close to the globe except the external rectus where ⅛ inch was left as a handle. The enucleation was completed in the regular way. The ivory, previously boiled, was inserted, after all bleeding had ceased. Muscles were tied together over it, broadening out each in order to give greater function. Tenon's capsule was brought together with interrupted sutures, using the same material, completely closing up prothesis. The conjunctiva was united with a horizontal whipped-stitch black silk suture, leaving the ends untied. The eye was dressed as usual.

The child felt comfortable after operation. The bandage was removed on the fifth day. There was no elevation of temperature and no reaction in

the surrounding tissues. The silk suture was removed on the seventh day and the patient discharged from the hospital. An artificial eye was inserted on the fourteenth day and is being worn with comfort. Cosmetically, a perfect result was obtained.

Ivory has a special advantage over glass as it can be shaped so that the muscles will stay as sutured; the greater smoothness and shape of a glass ball may cause the muscles to slide off the surface and become contracted posteriorly. In case of infection, ivory can be removed from the socket and reinserted at a later period, just as Magitot does in marsupalization.

The prothesis is very simply prepared by taking one inch cube of ivory, rounding off all corners and flattening out all edges and corners with carborundum driven by electric motor. We approximated a sphere, but not perfectly. This, in my opinion, makes an ideal implant after enucleation.

1908 Eutaw Place.

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THE INTERPRETATION OF RETINAL FOLDS.

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Brighter illumination with the Gullstrand binocular ophthalmoscope and use of red free light emphasize the reflections from the retina and help the study of variations in its contour. Coalesence of the retinal layers at the macula causes radical folds about it. A photograph illustrating such folds is here reproduced. Read before the Colorado Congress of Ophthalmology and Oto-Laryngology, July 16, 1926.

The observation and interpretation of folds in the retina present an interesting phase of the ophthalmoscopic study of the fundus. The introduction of improved means of observation has greatly stimulated the study of these important retinal changes. An increase in the illuminative power such as we have in the larger electric, the Gullstrand binocular ophthalmoscope and in the use of red free light, discloses an abundance of reflections which are due to changes in the contour of the retinal surface.

The introduction of red free light by filtration for ophthalmoscopic illumination by Vogt has opened a new era to fundus observation. His observations were made with a perfect red free filter and a microarc lamp. They can not be made with the semired free lenses that are found in many of the present day hand ophthalmoscopes. A true red free light filter will show the normal living macula canary yellow in color.

Among the many advantages derived by using red free light, is the one that with it we are able to see a greatly increased number of reflections from the anterior retinal surface. This is possible because of two factors: a predominance of short wave rays and an obscuration of the usual reflection from the choroid. Red free light allows of a greater differentiation within the retina because it produces an increased opacification of the latter. The reflections from the choroid are in variations of red and therefore are rendered less visible by red free light, hence choroidal changes are correspondingly obscured.

Retinal folds in older persons and such as are less pronounced are visible only by means of red free light.

I will first briefly discuss the anatomic substratum of retinal folds.

Folds in which the whole of the retina is involved are especially seen in cases of retinal separation, tumors, the scar contraction following exudative retinitis (retinitis proliferans) and at times if large foreign bodies have been imbedded in the retina.

These folds usually extend from the lesion to the nervehead, hence are radial to the latter. More interesting and more frequently seen are folds of the anterior retinal surface, that is the limitans interna. This limiting membrane of the retina is frequently separated from the nerve fiber layers by fluid in cases of retinal edema. As the edema subsides folds of the anterior retinal layer are seen.

Just as the slitlamp has exposed so-called folds in the cornea as being strictly confined to Descemet's membrane, so experience with red free light has proven the limitation of a preponderance of retinal folds to the internal retinal limiting membrane.

Retinal folds in which the limitans interna forms the anterior folded surface may be dull or reflecting. In the latter case they will show double contoured preretinal reflex lines.

These folds of the inner retinal surface may be dull with ordinary light while with an increased source of illumination or in red free light they may show reflex lines. The difference in behavior in this instance is due to the illuminant alone. Dull folds do not reflect because the limitans interna and usually transparent retina behind it are in a state of edema and cloudy swelling.

Recovery manifests itself by a return to transparency and a change from a dull to a reflecting surface. This metamorphosis may at times be observed in adjacent retinal areas, dull folds may even merge into such as will show reflections. Beyond middle life

the anterior retina is more opaque hence preretinal reflex lines will not be found with ordinary illumination. In order to see retinal folds in age, red free light must be the illuminant of choice.

The vitreous surface adjacent to the retina may also be folded and give origin to reflecting folds. This must be accepted in view of the occasional finding of linear reflexes which extend onto and over the disc.

Regarding the direction of folds:

Irregular folds of the retina are seen in connection with scar contraction, tumors, detachment, and following edema of the papilla. These extend in the direction of traction, or they may be due to a lateral displacement of tissue (corrugation folds).

The direction of folds is influenced by the position of the lesion in its relation to the other points of retinal fixation: the disc and ora serrata. They are therefore often radial to the disc.

Folds that are radial to the macula are seen after contusion, in iridocyclitis, optic neuritis, after exudative retinitis, thrombosis, embolism, retinitis pigmentosa, hole in the macula, and in acute retrobulbar neuritis.

The radial direction of the folds is due to the fact that the limitans interna is more intimately connected at the macula with the underlying retinal structures. That this is the case has been proven anatomically by Dogiel.

A case quoted by Vogt of hemorrhage into the anterior retina (so-called preretinal, but in reality back of the limitans interna) gives added proof of this more intimate attachment. The blood in this case had spread over a large intraretinal area but it almost completely spared the macular region because of the more intimate cohesion of the layers in this modified retinal area. Therefore the macula presents a point of fixation for the various retinal layers, hence the radial direction of superficial folds.

Fig. 1.—Photograph of ocular fundus, showing reflexes due to retinal folds. The white figure-of-eight, near the center, is the double reflex of the light source, from the surfaces of the lens of the camera.

A case of folds radial to the macula is shown in the illustration. It is a photograph of a fundus taken one week after trauma. The patient was injured by a wrench. There was a

very large cut in the bulbar conjunctiva and one thru the upper canaliculus. Apparently there was no injury to the eyeball (slitlamp examination) with the exception of the radial folds seen passing over the foveal rim.

These folds were visible only with intense illumination.

The immobility of the retinal layers at the macula and the retina at the disc creates two fixed points and thereby also allows of the development of vertical folds in the area between these two points.

Very delicate vertical folds in this area between the macula and disc in youth may be considered as normal. I have seen a case of dull vertical folds in this area with ordinary illumination as well as with red free light in the case of a boy after orbital cellulitis.*

Either the long continued pressure against the eyeball or more likely a local toxic absorption may have caused a retinal edema in this case. This edema was later followed by the development of these interesting vertical folds between the macula and disc.

*American Journal of Ophthalmology, June, 1920, p. 447.

SUMMARY.

1. Retinal folds may involve the retina as a whole, the limitans interna, or they may be simulated by a folding of the vitreous surface adjacent to the retina.

2. The direction of folds is determined by the points of retinal fixation—lesions, the ora serrata and disc, as well as the cohesion of the retinal layers at the macula.

3. Folds that radiate from the macula likely involve the limitans interna only, because of the intimate attachment of the retinal layers to one another at this point.

4. Dull folds may have the same substratum as reflecting folds. The latter are evidences of the retinal transparency of youth or a recovery from the opacity of edema or cloudy swelling.

5. Red free light enhances our ability to correctly interpret these interesting phenomena.

MECHANISM OF ACCOMMODATION.

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Accommodation is effected by the crystalline lens; but whether by intrinsic or extrinsic forces is still unsettled. Discussion has been, too much, opposition and support of Helmholtz' theory. This paper takes up accommodation as accomplished in the eyes of lower animals, before considering the anatomy and physiology of the human eye. Experiments on living eyes are discussed, and the curvature changes demonstrated in the human eye. Observations on the curves of the lens, fixed when under the influence of eserin and atropin, are described and illustrated; and the anatomy bearing on the changes in form of lens discussed. Read before the Chicago Ophthalmological Society, May 17, 1926. See p. 55.

Perhaps the most astounding thing about the subject we are about to discuss is the lack of general interest in it. The problems pertaining to the measurement of the functional efficiency of accommodation and its derangements are a daily experience in ophthalmic practice. Yet, we bestow only a small fraction of our routine discussions to a consideration of the actual mechanism of accommodation. Altho the literature on this problem is voluminous it for sincere painstaking research in this field should contain, at least, the has been created by individual rather than general effort. A roll of honor names of Thomas Young, Cramer, Donders, Mueller, Helmholtz, Hensen, Voelckers, Schoen, Tscherning, Beer, Grossman, Hess, Heine, von Pflugk, and Thomson Henderson.

The indifference on the part of the general profession is no doubt due to the unquestioning acceptance of the simple, yet amazing, theory of Helmholtz. The apparent adequacy of the Helmholtz hypothesis has persuaded many able scientists, like himself, to hold on to it as the best available explanation. Its simplicity, which permits a comprehensive statement of it to be made in a few words in a schoolboy's compend of physiology, has led to a widespread acceptance of it as a fact. Helmholtz's original statement was only a cautiously expressed assumption.

At the recent convention of the English Speaking Ophthalmological Societies in London, Henderson presented a rather speculative paper on "The Postural Activity and Evolution of the Ciliary Muscle in Mammalia, a Study in the Mechanism of Accommodation." At the close of his presentation there was no further discussion, but the question was asked whether Henderson had any further proof to offer for the elasticity of the lens, which formed the basis of his presentation. He answered that he had not; that everyone today, including Sir Charles Sherrington, conceded the correctness of the Helmholtz theory, and that no one agreed with Tscherning, etc. He then added that it was quite obvious that elasticity of the lens existed; as shown, for instance, in case of a luxated lens; and that Grossman by his observations on a case of aniridia had clearly demonstrated what Helmholtz had originally shown. As in this instance, so unfortunately it has been quite the rule, that any discussion of the mechanism of accommodation takes the form of an attack upon or defense of the Helmholtz theory. Tscherning[1] in deploring this phase of the controversy states that "large trees cast large shadows, shadows in which nothing grows."

It is true that almost no one questions the Helmholtz theory; and that Tscherning, in his search for a more satisfactory coordination of fundamental facts, stands very much alone. However, despite Henderson's statement, it is not true that cases of subluxated lenses afford actual proof for the elasticity of the lens, and thus give support for the Helmholtz idea. Furthermore, Helmholtz[2] himself never proved the elasticity of the lens, but frankly assumed it. Finally, the observations of Grossman[3], to which Henderson alluded, gave no proof for the elasticity of the lens but merely demonstrated that the diameter of the lens is less during accommodation. From this one might assume elasticity · like-

wise one may conclude that the equator of the lens is compressed by the pressure of the vitreous against it, as explained in later publications by Tscherning and as previously stated by Cramer and Schoen. Henderson seems to ignore the fact that the diminution of refraction toward the periphery of the lens which, as Tscherning pointed out, is shown by Grossman's own report, indicates that compression is obviously the correct explanation of demonstrable lessening in diameter. Evidently a better conclusion was expressed by Bouchart[4] reviewing this controversy between Grossman and Tscherning: "The question remains open, but important information is accumulating which will lead to an exact knowledge of the facts."

Let us try to review the facts that have been accumulated. Time and space compel the elimination of needless discussion of the numerous theoretic proposals, more or less related to the facts we are trying to correlate. Shall we not attempt, both in eliminating and collecting material, to avoid the personal bias, always present when a theory is first set up and then facts are fitted to the theory?

Four general schemes to explain the accommodation of the eye for near vision present themselves. First, there may be elongation of the eyeball, or modification of the convexity of the cornea. This theory was disproven and eliminated by the experiments of Thomas Young. Second, we may consider increased convexity of the crystalline lens, due to an inherent tendency to assume the spherical form when permitted to do so by the removal of external restraint. This is the Helmholtz hypothesis. To eliminate the personal nomenclature it might be called the "intrinsic" theory. The fully accommodated lens then must be its true shape ("vraieforme") which it will assume when relieved of all external hindrances. Third, it is apparent that accurate vision for near objects can be attained by changes in the position, or form, of the crystalline lens due to direct influence of external forces. In contradistinction to the former this might be designated as the "extrinsic" method. Fourth, the necessary modification of the form of the crystalline lens could be brought about by a combination of internal and external influences, i. e., a mixed "intrinsic" and "extrinsic" hypothesis.

COMPARATIVE ANATOMY OF ACCOMMODATION.

To begin a study of the mechanism of accommodation, a scientific naturalist, in our time, will turn first of all to comparative anatomy. A short review of the mechanism found in other vertebrates is both interesting and instructive. Other zoologic groups may well be omitted as their ocular structures are so different that they will furnish nothing of consequence for this discussion. In presenting these notes I shall quote freely from Kalt's[5] excellent survey of the entire subject.

Fish must see under water, hence we shall expect their eyes to be highly myopic when examined in air. Hirschberg has been credited with being the first to measure the ocular refraction in a living fish. He found in air a myopia of 30 to 40 diopters in one species, but believed that this became emmetropia under water. Beer made a more complete study of the question and found that fishes are naturally myopic, even in water. Their eyes normally when at rest are adapted for near vision, and are accommodated for distance by displacement of the lens backward toward the fundus. When at rest, the lens, which is a sphere, lies against the posterior surface of the cornea. It is suspended by a ligament above, while below there is a muscular attachment which serves to pull the lens backward and somewhat downward and outward (temporarily). This action reduces the refraction and permits a greater range of distant vision. Under electrical stimulation this change is very rapid in some species and slow in others. There is also a variation in the amount of lateral displacement in different species. Cutting the retractor muscle, or campanula, stops all such accommodative changes, and thereby demonstrates its function conclusively.

The lens undergoes no demonstrable change in shape. Direct ophthalmoscopic examinations and retinoscopies of fish under water (in glass vessels) with curare and without, have shown changes of refraction incident to accommodation, ranging from 3 to 12 diopters under water and estimated equal to 40 to 60 diopters in air. The iris in fishes is an insignificant structure. Often it does not even cover the equator of the lens. Piscine accommodation thus depends entirely on displacement, and no hint of elasticity of the lens is to be considered as its form remains unchanged.

Among *amphibians,* as among all other vertebrates except fishes, the eye is normally adapted for distance, and accommodates for near objects. However, accommodation is not very active, and the form of the crystalline lens is not changed. Some amphibians, frogs for instance, show no evidence of accommodation. Frogs are usually emmetropic, or slightly myopic, in air, hence they become hyperopic when under water. Salamanders are emmetropic under water, hence highly myopic in air. Another interesting observation is that those emphibians of predominating nocturnal habits are usually deprived of accommodation, but have pupils capable of marked myosis. The latter supplies the needed sharpness of vision and protection in daylight, while accommodation at night is superfluous. In this group the crystalline lens is displaced toward the cornea during accommodation, thus increasing its distance from the retina. The mechanism is as follows: the ciliary muscle compresses the vitreous body, and the latter in turn pushes the lens to the front. During this action the aqueous humor accumulates at the periphery of the anterior chamber, and lightly presses the iris backward. The movements of accommodation take place slowly, and are completely suspended by opening the posterior segment of the eyeball. Here we have the beginning, in a very rudimentary form, of the process of accommodation, as we see it in higher types of vertebrates. The lens is pushed forward to improve near vision, by compression of the vitreous thru the ciliary muscle; but its form is not changed and the amount of accommodation is small.

In the group of *reptiles,* those living in air when examined in air, and marine turtles when examined under water, show a static refraction of slight hyperopia or emmetropia. The majority of reptiles have an active accommodation for near objects; in some, of amphibious habits, it is very considerable. Again as in the previous group, accommodation is feeble among those of nocturnal habits. There is no change in the shape of the crystalline lens in the eyes of serpents; but in lizards, turtles, and crocodiles the convexity of the lens is increased during accommodation. The mechanism is now more elaborate. As before, the lens is pushed forward by the vitreous, which is compressed by the contraction of the ciliary muscle. As the lens moves forward it meets with resistance at its periphery, from a circular muscle at the base of the iris; which compresses its equatorial zone while the pressure from behind causes its central or pupillary zone to bulge forward. Thus the convexity of the lens, and consequently the power of refraction, is increased at the same time that the lens moves away from the retina. We have here the connecting link between the mechanism of accommodation in mammalia, who depend chiefly on a change of form in the lens, and the mechanism in amphibia, who depend solely on displacement of the lens.

As might have been anticipated the mechanism of accommodation in *birds* is very similar to that in reptiles. This is only another of a number of striking resemblances between these two groups. In considering the changes incident to accommodation in birds' and reptiles' eyes the term "anterior lenticonus" becomes a reality. The bony ring in the ciliary region of the sclera of birds seems designed to resist the most powerful contractions of the ciliary muscle. It is apparent that birds probably make more excessive demands on accommodation than other animals. Birds require the best pos-

sible distance vision, added to the capacity to distinguish tiny seeds or insects. It is quite within the realm of reasonable probabilities that the pecten—that queer vascular erectile tissue which projects into the vitreous, in all species of birds except the apteryx—may have as one of its functions the maintenance of adequate resistance within the vitreous. It may prevent the extensive distortion of the visual field by violent traction of the ciliary muscle, compressing the vitreous during intense efforts of accommodation. Hess[6] concedes that there is no longer any controversy in regard to the mechanism of accommodation in birds' eyes. Cramer's experiments, quoted by Helmholtz[2], have been fully sustained.

Accordingly, until we come to the *mammalia*, the changes incident to accommodation are fully explained by extralenticular action (the "extrinsic" plan) modifying the shape or position of the lens. There is no occasion for the assumption of any special elasticity of the lens or its capsule. Even the line between birds and mammals is crossed by Cramer's experiments with seals, likewise recorded by Helmholtz[2]. Cramer demonstrated the changes in the appearance of the retinal image of a distant candle flame, due to accommodation produced by electrical stimulation of the freshly enucleated eye of a young seal, by direct observation thru a scleral window at the posterior pole. Then he made a radical incision completely dividing the iris, from its

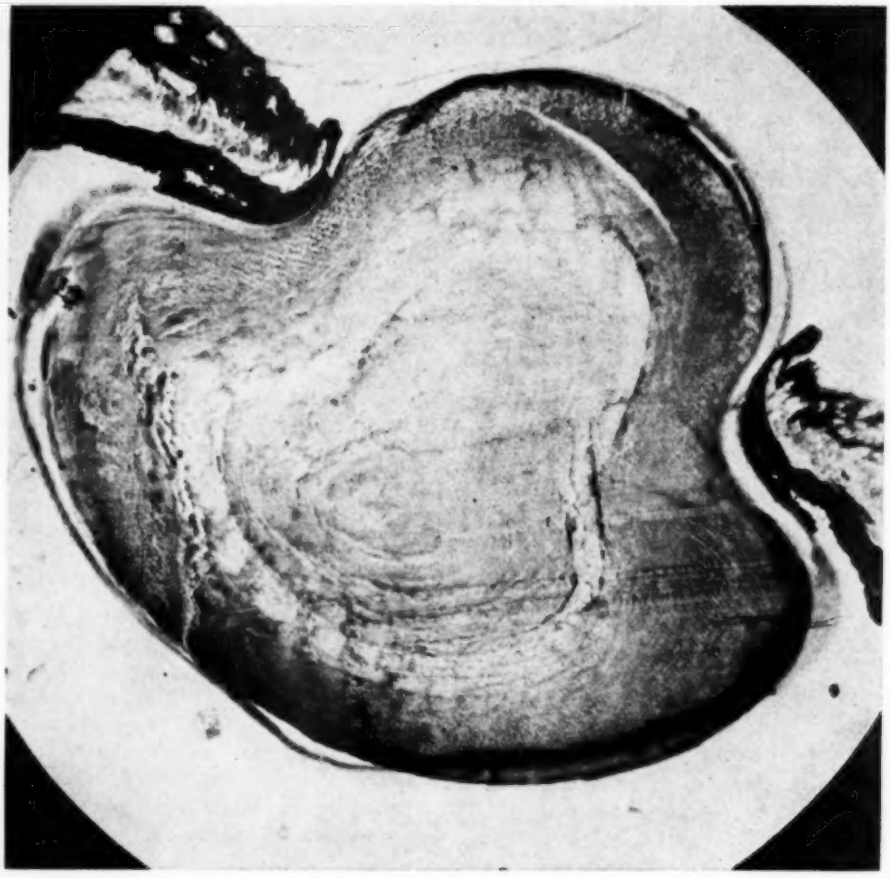

Fig. 1.—Crystalline lens of soft shelled turtle, in accomodation. The lenticonus is marked, the iris short and thick, the muscle layer thickened, the lens pushed against the iris resistance. (W. G. Gillett). Ref. 34.

base to its pupillary border. After the iris was thus divided, no further demonstration of accommodation could be made. Thus, in this species of mammals the iris played an active part in the mechanism of accommodation, as in birds. The experiment did not succeed in dogs and rabbits. It is quite likely that in its adaptation for life under water, as well as in air, the seal has been endowed with a more powerful mechanism for accommodation than most mammals. According to Kalt the power of accommodation among the mammals, except for man and monkeys, is quite feeble. Hess and Heine[7] report that they found no accommodation in eyes of rabbits, about 1 diopter in cats, 2.5 to 3.5 diopters in dogs, and 10 to 12 diopters in certain monkeys.

THE HUMAN EYE.

In a discussion of the mechanism of accommodation in the human eye we may quite properly begin with Helmholtz's[2] own statement which may be directly translated as follows: "According to Cramer and Donders the changes in the form of the lens are produced by the action of the ciliary muscle and iris thru increase of pressure within the vitreous and against the periphery of the lens, thus leaving only the anterior pupillary zone free from pressure. It is indeed possible thus to explain the increased convexity of the anterior lens surface which Cramer has observed. The changes in the form of the lens, according to deductions from my measurements may not be explained without the aid of some other factors. Thru the hydrostatic pressure exerted upon its posterior surface, as well as upon the periphery of the lens, it is not likely that the center of the lens can become thicker (increased axial diameter). Such pressure would tend to push the equator of the lens forward and flatten its posterior surface. An assumption which appears to be feasible, to clear away this difficulty, would be that the lens at rest, in distance vision, is held under tension by the zonula attached to its border. The folds of the zonula proceed from their attachment to the border of the lens outward and backward, forming sheaths for the ciliary processes and finally merge at the posterior extremity of these processes with the limiting membrane, the retina, and choroid. When the ciliary muscle contracts it can draw the posterior end of the zonula forward and thus diminish the tension. When the zonula is under tension, the equatorial diameter of the lens must be increased, its axis shortened, and its surfaces flattened. When the pull of the zonula is relaxed in accommodation for near vision the equatorial plane becomes smaller, its center becomes thicker and both surfaces will become more convex. Adding now to this the pressure from the iris, then the equatorial plane of the lens will be bulged forward and thereby the convexity of the anterior surface will be increased while that of the posterior surface is diminished so that the curvature of the latter may be practically the same as for distance vision."

"In this manner it seems the changes in the form of the lens may permit an explanation. Besides, it has been possible to produce changes in the shape of dead lenses by pulling on the zonula. In this connection may be placed the circumstance that I have found the measurements of the thickness of lenses of living eyes less than that of dead lenses." This direct translation preserves that striking impression of reserve and uncertainty which is derived from reading the original. *It might possibly be explained in this way*, is his unmistakable meaning.

Helmholtz was ready to concede the correctness of Cramer's and Donder's explanation for the mechanism, which was in line with what Cramer had demonstrated in pigeons' and seals' eyes, except that the vitreous did not obey the laws of hydrostatic pressure. That this objection was invalid may be better understood today, since it is known that the vitreous is not a liquid but in reality a true tissue. As such it is not bound by the laws of hydrostatics. The vitreous possesses a firmer consistency than the cortex of youthful lenses. According to Merkel, when absolutely fresh the con-

sistency of the vitreous is truly gelatinous ("gallertartig"). On sectioning it very little fluid exudes. It is only after cadaveric changes that the substance of the vitreous becomes more and more liquefied. It is to be noted that these changes become manifest very early. Park Lewis[8] very properly insists that the vitreous "is not a simple homogeneous mass supporting the retina—but that it is itself an active agent in the accommodative process and an essential part of the combined lenticular system."

Another anatomic misconception is conveyed by Helmholtz's use of the terms folds ("Falten") and sheaths ("Scheiden") in relation to the zonula. The zonula is a system of fibers or cords, but in no sense a membrane. The importance of this detail will be discussed later.

Furthermore, it may be that Helmholtz does not give sufficient consideration to the structure of the lens. The lens is not a homogeneous mass. There is definite differentiation between its nucleus and cortex. The former is firm and resistant, and the latter yields easily to pressure. Even simple hydrostatic pressure, exerted against the posterior surface of a capsular bag containing these two substances—nucleus and cortex—is not necessarily going to lessen the curvature of that surface. We may even get an increased convexity at the center of the posterior surface, if the soft cortex is pushed forward to the anterior surface and compressed about the periphery; while the nucleus, which resists change in shape, remains posteriorly at the center of the mass.

The most unthinkable thing about the "intrinsic" theory is the assumption, that in a state of rest the lens is held under constant tension. We seldom stop to realize what it means. We are asked to assume that this incessant strain is present thruout every moment, sleeping or waking, except when the eye is accommodated for near vision. Schoen[9] states that it is impossible. Gifford[10] in a recent discussion stated that he found it most difficult to understand how the embryonic lens could grow into this state of tension. Henderson[11] tries to sustain this tension by imagining a postural activity of different parts of the ciliary muscle, similar to that exercised by the erector spinae (muscle of the back). He says it is unreasonable to ascribe the maintenance of this tension to the delicate tissues of the retina and choroid. If we accept Henderson's explanation, we are obliged not only to imagine the elasticity of the lens but also to follow him when he states that: "The ciliary muscle lies *normally contracted in a phase of rest* thereby supporting the zonula curvature and keeping taut and so maintaining the lens flattened." Accordingly, "in accommodation a *simultaneous impulse of inhibition*, i. e., relaxation of the radiating tensor fibres with *reciprocal excitation or contraction* of the ciliary sphincter fibers, will lower the zonular curvature and so, by relaxing the tension on the lens permit it to assume a more convex form."

Reversing the process, atropin would paralyze one part of the ciliary muscle and removing the inhibition would stimulate the other to contraction. All this is proposed in direct contradiction of the histologic, experimental and clinical evidence, showing the ciliary muscle to be completely paralyzed by atropin. Henderson's suggestion that sympathetic innervation plays a part in the process of accommodation is not new, but was disproven conclusively by elaborate experiments of Hess[12] and others. This proposal of postural activity" of the ciliary muscle, based on similar activity in other parts of the body, has been advanced only to make a necessary allowance for the constant tension incident to the elasticity of the lens, which is purely an assumption. It must be acknowledged that nowhere in the animal kingdom is there any evidence of elasticity under the conditions imposed by Helmholtz. This question of the existence of such elasticity in the crystalline lens must constitute the keynote of all research related to this mechanism.

EXPERIMENTS.

The earliest and most effective experimental support for the Helmholtz

theory was supplied by the extensive and carefully executed experiments of Hensen and Voelckers[14] on dogs' eyes, published in 1868. Their work and their report of it constitute in many respects a model for scientific research. Their careful distinction between the actual observations and the interpretation of them is quite refreshing.

Hensen and Voelckers inserted needles thru the sclera, at various points, into the ciliary body and choroid of dogs' eyes. Upon electric stimulation the contraction of the ciliary muscle invariably caused an excursion backward of the outer tip of the needle, showing that the point within the eyeball was being carried forward. By careful measurements of the external arc of needles at various points, it was possible to get definite information concerning the amount of the anterior displacement in the choroid. It was shown that this movement became progressively less, and finally ceased at the posterior pole of the eye. By the same method, they were able to show a slight movement forward (one-half millimeter) of the lens at its equator, and a slight movement backward at its posterior pole. By cutting a window in the sclera over the ciliary body and the anterior segment of the choroid, they demonstrated that contraction of the ciliary muscle pulled the choroid forward, while the ciliary muscle itself sank inward. By electrically stimulating the ciliary ganglion after the eyeball had been cut in half, they demonstrated that the segment of the vitreous nearest the lens bulged forward, while the periphery lying next to the sclera sank inward, a reaction to be explained only by the movement of the choroid.

Hensen and Voelckers[15] frankly admitted that this meant some compression of the vitreous body, but they did not speculate about the possible effect of such pressure by the vitreous upon the shape of the lens. Obedient to the profound respect universally held for the opinions of Helmholtz, they tried at once to interpret what they had found in relation to the theory he had proposed. It seemed to fit perfectly if you merely assumed elasticity of the lens, as Helmholtz did. So they accepted it and tried to explain it by supposing that the lens was made up of tubules, which filled with fluid when the zonula was relaxed by the advance of the choroid. Then, as these filled tubules tried to stretch or straighten out, the mass of the lens became more spherical in form. Hensen and Voelckers[16] did not try to disguise the fact that this was pure speculation. They stated that it was essential to offer some explanation, as this elasticity constituted the very kernel ("Kern") of the entire matter.

ELASTICITY OF LENS AND CAPSULE.

Elasticity is defined as "that property of a body which causes it to resist deformation and afterward to recover its original shape and size." If an elastic response is the basis for the increased convexity of the lens then this property must be most pronounced in lenses showing the greatest capacity to accommodate, that is in those of very young eyes. Hess, the greatest among the modern defenders of the Helmholtz "intrinsic" theory, makes the following statement with reference to lenses of youthful eyes. "How a slight, an outward influence, may change the form of a youthful lens is demonstrated, for example, by the fact that even when the lens lies on a level surface it is noticeably flattened by its own weight. Compare this statement with the definition[13] of elasticity quoted above and how much elasticity would you say existed in youthful lenses?

It is very evident that Hensen and Voelckers, as well as Helmholtz himself, believed that elasticity was a property of the mass of the lens. That is also the popular conception today. We must exclude, of course, the firm nucleus of the lens. We know that accommodation becomes progressively less, as the nucleus hardens and becomes larger with age. Critical examination of the cortical layers of the lens fails to show evidence of this indispensable quality, elesticity, so necesary for the "intrinsic" mechanism of accommodation. Even an enthusiast like Hess acknowl-

edges this. While Helmholtz thought that the lens was an elastic body ("ein elasticher Koerper") Hess[17] states that "the elasticity is due chiefly to the capsule of the lens, for when the capsule is stripped off the superficial layers of the lens are more mucoid than gelatinous in consistency and have no tendency to assume any specific shape or form."

In the latter part of the paragraph from which this translation was made, Hess refers to the fact that Schweigger repeatedly demonstrated the tendency toward a spherical shape in liquefied lenses. This he cites as proof for capsular elasticity. A drop of water, in obedience to the laws of surface tension, will assume a spherical form. The same laws apply to liquefied lenses. The role of the capsule, therefore, may be and probably is entirely negative in this connection.

Thus we see that Hess repudiates the proposal of Helmholtz, Hensen and Voelckers and others, in regard to the elasticity of the cortex or of the substance of youthful lenses; nor does he offer any other evidence for the elasticity of the capsule, except the reference to liquefied lenses. Careful reading of his statement indicates that he assigns the elasticity to the capsule, because it is not present in the lens substance. Such an assumption does not constitute proof. Studies of the empty capsule by Basil Graves[18], with the aid of the slit lamp, show moderate waviness of both anterior and posterior capsules under eserin, while they remained rather smooth or tense under atropin. This observation, which indicates a relaxation of the suspensory apparatus of the lens under eserin, confirms my own observation of the lens capsule of the monkey's eye under eserin, on histologic examination, reported in 1909[19]. Neither comment affords any proof for elasticity of the capsule. It may be definitely stated that this elasticity has never been demonstrated. Helmholtz offered only one suggestion of the proof of his hypothesis, and that referred to the slight increase of thickness in the lenses after death. Tscherning was able to show sources of considerable error in such measurements. In fact repeated measurements show, that while the thickness may be increased, the surface measurements indicate that the convexity does not approach that of the accommodated lens. Thus dead lenses offer a direct contradiction, rather than a support, for the "intrinsic" hypothesis. According to Hess the measurements of dead lenses give results that are entirely unreliable. We may, therefore, dismis this suggestion of Helmholtz as it affords no competent evidence.

CURVATURE OF SURFACES.

The curvature of the anterior and posterior surfaces of the lens may be calculated from measurements of Purkinje's images. These measurements have been repeated by many observers, and have shown considerable variability in the size and curvature of lenses in different individuals. There has been no small amount of dispute concerning the significance of certain measurements. All trustworthy observers agree, that there is sufficient increase in the convexity of the lens to account for the phenomena of accommodation, and that there is no external change in the shape of the eye, no elongation, or increased convexity of the cornea, playing a part in this important function. The extraocular muscles only maintain the proper relation between the visual axes of the two eyes, necessary for binocular vision.

By measurements of the peripheral zones of the lens, Tscherning found that the refraction of the center of the lens is increased much more than that of the periphery during accommodation. This indicated a somewhat cone shaped bulging of the anterior surface, rather than the general spherical form of the entire lens as assumed by Helmholtz.

Objection was made to Tscherning's calculations of these differences, on the basis that the outline of the anterior lens image is rather indefinite and therefore unsuited as a basis for computing the form of the peripheral parts

of the lens, where the difference in density between cortical layers might be a further source of error. If the cortex of the lens constitutes such a noteworthy source of error, then practically all measurements of the lens in situ become valueless. Hess, furthermore, lodged objection to the direct measurements of the anterior surface of the lens made after the removal of the cornea, because the lens is thus exposed to air and not completely surrounded by fluid as normally. Thereupon Hess [20] rather inconsistently offers as evidence the apparent enlargement (uncontrolled by actual measurements) of the anterior lens image of a frosted incandescent bulb, produced by pulling with several forceps at various angles of the zonula in a monkey's eye, from which both the cornea and iris had been removed.

However, Tscherning's calculations, showing an anterior lenticonus with relative flattening at the periphery of the lens during accommodation, instead of general sphericity, were supported by the much earlier observations on spherical aberration made by Thomas Young[21]. Young noticed that the spherical aberration of the crystalline lens became markedly less during accommodation for near vision. If the lens became more spherical, according to its inherent assumed elasticity, spherical aberration should be increased during accommodation, except as it might be modified by the coincident myosis. Young's experiments were repeatedly confirmed by Tscherning, so that the latter became convinced that this condition was the rule rather than the exception. Hess and Heine took the attitude that such demonstrations were only possible in exceptional cases. Even if this happened only exceptionally, it would constitute excellent evidence that the lens does not merely become more spherical during accommodation; but that it undergoes a definite deformation, resulting in a central bulging with relative peripheral flattening.

If time permitted a review of Young's and Tscherning's notes on aberration, as demonstrated by slits and points of light, would be interesting and instructive. Tscherning's[22] measurements, arranged in the following tables, show that the increase in refraction at the periphery of the lens during accommodation is notably less.

	Central amplitude.	Peripheral amplitude.
Young	9.8 D	4.2 D
Koster	8. D	3.3 D
Demicheri	7.5 D	3.7 D
Demicheri	6. D	3. D
Demicheri	4. D	2. D
Mme. T.	6.7 D	3.8 D
Tscherning	3. D	1.25 D

Even more pronounced differences between central and peripheral accommodation were found, by holding two closely approximated slits directly in front of the center of the pupil and then at its nasal and temporal edges.

	Temporal border.	Center.	Nasal border.
Demicheri (Homatropin)	.....	6. D	2. D
Demicheri (Homatropin)	0	4. D	1. D
Mme. T.	5. D	6.7 D	5. D
Tscherning (Homatropin)	0.25 D	3. D	0

These measurements were made with Young's optometer, a simple instrument, based on the well known experiment of Scheiner. The results correspond in a general way with the change in outline of the anterior surface of the lens in the eyes of birds or reptiles during accommodation. From the standpoint of evolutionary development it is entirely correct. According to the "intrinsic" hypothesis of Helmholtz it should never happen in human eyes.

SHAPE OF LENS AFTER FIXATION.

It is evident that actual fixation of the shape of the lens would give information of the greatest value. Ordinary histologic methods of fixation were found absolutely unsuited for this purpose. Attempts to overcome this difficulty by rapid freezing seem to have yielded consistent results in the hands of von Pflugk[23] but not in Hess' laboratory. It would be interesting to compare the photographs of the results

of Hess and Fisher's experiments, so that an unbiased opinion could be rendered as to their value. Apparently Hess and Fisher have never published such photographs, but merely stated that the method is not satisfactory. von Pflugk's positive assertion that rapid freezing, by liquid carbon dioxid, can fix the eye in condition of rest or accommodation, supported by unretouched photographs demonstrating it, should be met if possible by more proof than a mere denial even from so great an authority as Hess.

v. Pflugk's series of examinations of frozen eyes included 47 pigeons' eyes (5 under atropin or curare, 21 under strophanthin, 1st stage, 7 with the lens at rest, zonula detached, and 3 otherwise dissected); and 11 monkeys' eyes (Macacus cynomolgas), one under atropin, 3 in natural state, 3 under eserin spasm, 3 with lens at rest (zonula detached) and one dissected eye.

v. Pflugk seems to be fully justified in making the following deductions from his photographs of the frozen sections. First, that changes in the posterior surface of the lens are a much greater factor in accommodation than previously surmised. Second, that tho the outline of the lens at rest does tend to become more spherical, it is more and more deviated from this spherical rest form as the effect of accommodation upon it is progressively increased. The lens of the eserinized eyes (the accommodated lens) was flattened at the periphery and bulged at the center, of both anterior and posterior surfaces. As this outline was increasingly different from the spherical form of the lens at rest, it could not be the result of relaxation. Therefore, v. Pflugk concluded that the underlying principle of the mechanism of accommodation, in man and monkeys, as well as in birds, is a tension of the zonula during accommodation.

An interesting comparative study of diagramatic drawings of the lens in accommodation made, at different periods, was presented by Tcherning[24] after the results of von Pflugk's researches were published. He showed that Helmholtz's original (1851) outline very nearly conformed to the photograph published by von Pflugk of the lens in a monkey's eye under eserin. There was definite flattening—even slight concavity—of the peripheral zone of the posterior surface. A later drawing of Helmholtz (1856) inclined toward a somewhat spherical shape, while a third figure by Landolt (1887) is frankly and unmistakably a sphere. Similar exaggerations provoked the remark of Tscherning that some of the followers of Helmholtz were "plus royaliste que le roi."

Continuing his search for misleading carelessness in the presentation of drawings, Tscherning checked those presented by Grossman in his report of observations on that interesting case of aniridia, as previously noted. Grossman's own figures are, for the diameter of the lens 12.25 mm. homatropin, 11.5 mm. at rest, 10.25 mm eserin; for the thickness of the lens, 3.14 mm. at rest, 4.44 mm. eserin. Tscherning expressed astonishment. He had never encountered a human lens showing more than 12 mm. in diameter. Grossman answered him that these figures did not make allowance for the enlargement due to the cornea. With proper corrections it was shown that Grossman's figures gave practically the same values that had been found in other cases by other observers. With corrections the measurements are as follows: diameter 10.2 mm. at rest, 9.1 mm. eserin; thickness 3.1 at rest, 3.9 mm. eserin. On applying Grossman's original figures to his own drawing of the outline of the lens we find that he multiplied the diameter by four, but increased the anterior posterior thickness by five and six times. Thus he produced an outline much nearer the spherical form than could properly be deduced from his calculations.

The following statement proves that even Hess[25] could not entirely ignore the evidence for the flattening of the peripheral zone of the lens. He writes "It is not unthinkable that the peripheral flattening of the lens assumed

by Tscherning, if it actually is a regular occurrence, has been inherited from our ancestors in the vertebrate order of animals; that the pressure exerted during accommodation in reptiles and birds has led to such changes in the structure of the lens as a result of which the lens finally, without direct pressure from the ciliary processes, singularly during the relaxation of its suspensory apparatus, may become flattened in the peripheral part of its anterior surface and only increased in convexity at its center."

This statement, which admits the possibility of the verity of Tscherning's and v. Pflugk's claims in regard to the shape of the lens, read very much like that of "a man convinced against his will who holds the same opinion still." It is significant that Hess felt obliged to make a note of this, even if he did not put it in small type as an explanatory afterthought.

If Hess thought it were possible that the human lens might take this shape, which has been shown to be due to external pressure in lower animals, why did he persist in saying that the changes present in the accommodated human lens are the result of relaxation, rather than tension of the zonula? The reason for this lies in the fact that Hess found very direct evidence which convinced him of relaxation of the zonula during accommodation. He states that "for correctness of the first part of Helmholtz's theory according to which the increased convexity of the lens is brought about by diminished zonula, the first complete proof is the demonstration of trembling of the lens (Linsenschlottern) and the sinking downward of the lens under *strong* physiologic accommodative effort."

Demonstrating this loosening or quivering of the entire lens and its sinking downward, however, does not prove that the elasticity exists which is necessary to produce the change in shape required by accommodation. Hess has discarded, as we have seen, the earlier idea of elasticity of the entire lens and has bestowed this function upon the capsule. As soon as this relaxation of the zonula occurs one might expect that the slack would be taken up instantly, by this ever alert elasticity in the capsule thus holding the lens steady and not allowing it to drop. These phenomena in fact seem to contradict rather than to furnish the "first complete proof" of the correctness of the "intrinsic" theory. To understand how this relaxation is possible, if the zonula is under tension during accommodation as stated by Cramer, Manhardt, Schoen, Tscherning, and von Pflugk, we must study its detailed structure.

E. Berger[26] expresses the view of all modern histologists, when he refers to the zonula as a system of small cords ("un systeme de petite cordelettes") which can in no sense be considered a membrane. This arrangement permits a degree of independence of action by the cords of the zonula running in different directions which is important in the discussion of this phenomenon of "Linsenschlottern." Gerlach,[27] whose name has been attached to the decussation of zonula fibers, explains that it is produced because the fibers which originate in the most anterior parts of the ciliary body terminate on the posterior surface of the lens, while another bundle is composed of fibers which originate from other parts of the ciliary body and end on the anterior surface of the lens. Terrien[28] distinguishes three principal groups of zonular fibers; the accommodative (the most numerous), the suspensory (a lesser group), and the circular fibers which form a more or less definite ring and join the ciliary processes together. Salzmann[29] confirms these statements and adds, "To the atypical zonular fibers belong in the first place those coming out of the vitreous and the backward coursing zonula fibers, which we have already discussed. Here, too, belong the inter- and intraciliary fibers of Czermak, fine fibers uniting two ciliary processes with each other. Furthermore, the short and thick fibers going out of the corona ciliaris, directed at right angles to the typical fibers and serving for the fixation of these, described by Retzius, belong here. But in my opinion these

fibers do not unite with the typical fibers, but radiate into the border layer of the vitreous or go over into circular fibers."

The portion of the zonula most essential for the mechanism of accommodation, according to either the "intrinsic" or "extrinsic" theory, is the larger bundle of typical meridional fibers, which Terrien designates as the accommodative group. The crystalline lens and this large group of "cordelettes" form the anterior segment (about one-fourth) of a globe, which is completed by the choroid and retina and filled by the vitreous body. The posterior three-fourths of this globe lies next to the sclera, when at rest, and needs no other support. The ciliary muscle is outside of this globe, but acts upon it thru traction upon the choroid primarily. The anterior one-fourth of this globe hangs suspended by the lesser or suspensory fibers of the zonula, which are quite independent of the meridional fibers and decussate freely thru their interstices.

With these anatomic relations clearly fixed we are prepared to correlate the various phenomena that have been observed during accommodation and to eliminate the divergent interpretations. We can explain how it is possible for tension to be maintained and yet why at a *certain stage* of accommodation the lens sinks in response to gravity and "Linsenschlottern" may occur. Hensen and Voelckers[14-15] demonstrated that the first effect of contraction of the ciliary muscle is traction upon the choroidal sac with compression of the vitreous. This reacts immediately upon the lens producing some modification in its shape, thru direct contact and by increased tenseness of the larger bundle of zonular fibers lying next to the vitreous and inserted on the anterior surface of the lens.

Another effect of the contraction of the ciliary muscle is increased thickness of the ciliary body. Whenever a muscle contracts it becomes thicker. As soon as the increase in thickness of the ciliary body reaches a certain degree it protrudes inward and must relax the support of the suspensory portion of the zonular fibers sustaining the anterior one-fourth of the globe we have just described. The diameter of the ring formed by the interwoven mass of secondary fibers supporting the lens, must become smaller as the ciliary body becomes thicker during the contraction of the ciliary muscle. When this ring is smaller it no longer anchors the suspensory apparatus of the lens firmly, as it does when the ciliary muscle is at rest or during the earlier stage of its contraction. When this support is lost the lens

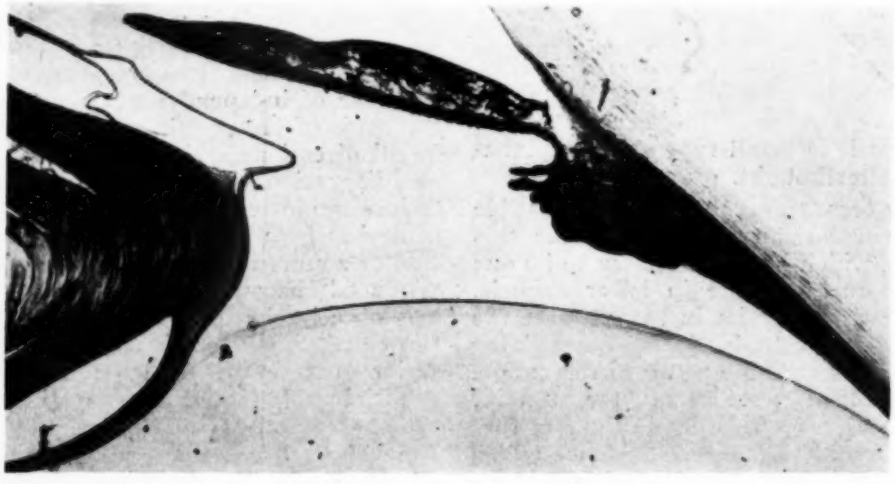

Fig. 2. Ciliary body, iris and circumlental space under atropin. Open space, between limiting membrane of vitreous, and ciliary body and lens capsule.

may sink down in response to gravity, and tremble with sudden jerking movements of the eye. However, nothing has happened to cause any relaxation of that portion of the zonula which sustains the pressure of the vitreous against the lens, which in turn is due to the direct traction of the ciliary muscle upon the choroid. We have here a simple explanation, based on anatomic data, for the demonstrable relaxation of the zonular support of the lens, which at the same instant is being pressed into its accommodated shape by the vitreous and held in this condition by the meridional fibers of the zonula.

the possibility of some auxiliary traction directly upon the vitreous, in the direction outward and forward. This movement outward and forward of the peripheral parts of the vitreous would explain the observations of Hensen and Voelckers, Tscherning, Basil Graves and others, that there is a slight retraction of the posterior pole of the lens during accommodation.

For histologic evidence of the role of the vitreous during accommodation, permit a reference to a report made to the XI International Congress of Ophthalmology 1909, concerning the experimental use of atropin and eserin in monkeys' and human eyes. The sig-

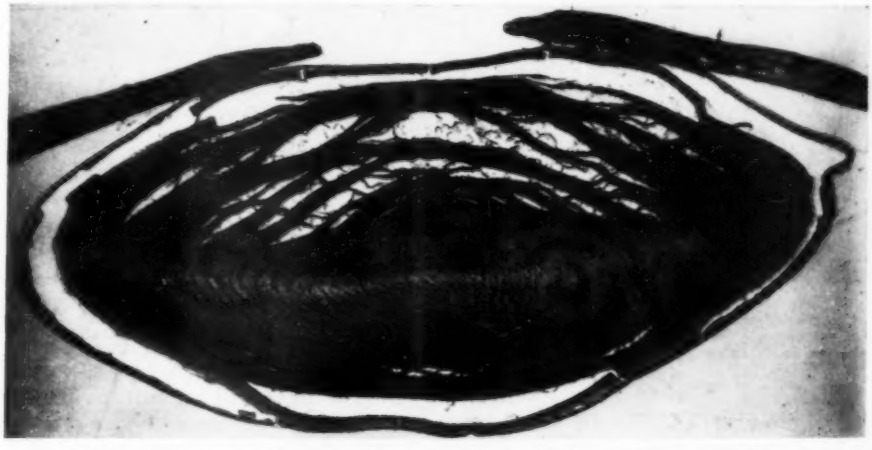

Fig. 3. Lens of Monkey's eye under eserin (vertical section) showing traction on capsule by suspensory fibers of zonule, above only. Dense nucleus of lens remains in posterior half.

This relaxation is not to be regarded as a mere accident due to the thickening of the ciliary body. It probably constitutes an important factor in the stronger efforts of accommodation, by removing the inhibition of the suspensory fibers, which would restrain somewhat the bulging at the anterior and posterior poles, especially the latter. The circular fibers of the ciliary muscle probably assist in this relaxation of the suspensory fibers. It is significant in this connection that these circular fibers seem to be more fully developed in hyperopic eyes, where the increased effort in accommodation is a natural necessity.

As it has been shown that some zonular fibers pass from the ciliary body into the vitreous, there remains

nificant thing found was the presence of a space, between the limiting membrane of the vitreous and the posterior surface of the periphery of the lens and the zonula, in atropinized eyes; and the complete closure of this space in fully eserinized eyes. One other point, not previously demonstrated, was the apparent traction upon the capsule of the lens, indicated by points of the capsule drawn outward on both sides of the atropinized eye, but only on one side in the perpendicular section of the eserinized eye. This latter was apparently due to gravity. Flattening of the corona ciliaris, under atropin, increases the diameter of the ring zonular attachment, and thus produces traction by the suspensory zonular fibers. The pressure of the vitreous against the

lens can be and is exerted, without regard for this suspensory traction. Study of the histologic sections indicates the total independence of these two functions of the zonula. v. Pflugk has shown that the shape of the lens under atropin is flatter than its outline at rest. This coincides with the above evidence, that there is traction by the suspensory cords upon the lens capsule under atropin.

More recently another human eye became available thru the courtesy of Dr. A. E. Ewing. An exenteration of the orbit had to be done on account of an extensive epithelioma. The patient, an elderly gentleman, was not to be subjected to the pain incident to the instillation of eserin. It was instilled only immediately before the general anesthesia. It was a keen disappointment to find that the pupil was dilated when the eye had been removed. The eserin solution was poured into the specimen bottle to see what would happen and fortunately good myosis was secured in a very few minutes. The eye was left in the eserin solution for fully one-half hour, before fixing it in formalin. When sections were made it was found that the entire choroid had been lifted off all the way back to the optic nerve. There seemed to be some tearing away of the retina and choroid at the disc. This was such unexpected evidence of traction upon the choroid, resulting from extreme postmortem ciliary spasm, that cutting of sections was stopped at the edge of the disc to permit study of the available sections and then to secure serial sections thru the disc. Unusual delay caused the specimen to dry up in the celloidin block. The microphotographs here presented were made from one of the earlier sections. The other photograph shows the dried specimen in the celloidin block. It is a striking example of an anterior lenticonus.

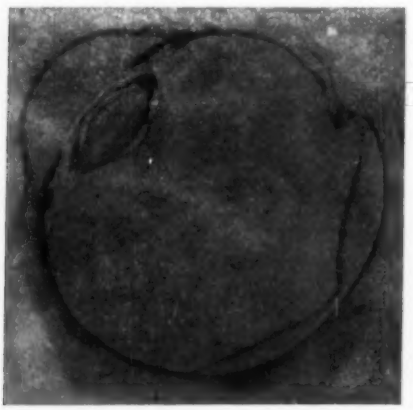

Fig. 4. Cross section of Monkey's eye under atropin. Traction on capsule by suspensory fibers of zonule noticeable on both sides.

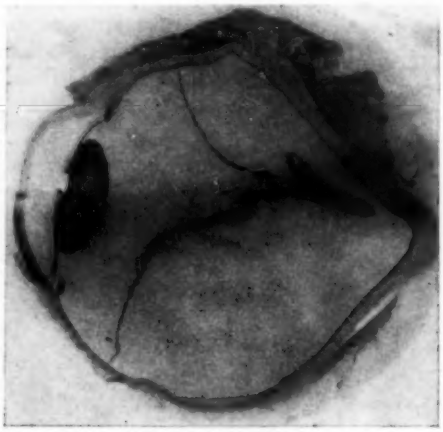

Fig. 5. Cross section of human eye showing postmortem effect of eserin. Detachment of entire choroid and posterior end of ciliary body.

This is probably a mere accident in the drying process, however, it suggests that the softer lens substance has been pushed forward, while the firm nucleus remained posteriorly under the postmortem eserinization. One other eye was secured later at the Bernard Skin and Cancer Hospital, thru the courtesy of Dr. W. E. Leighton, and an attempt was made to study the postmortem effect of eserin. This was successful so far as the iris was concerned, good myosis being obtained. Relations within the eye posteriorly were disturbed by the fact that the sclera collapsed during fixation and hardening.

Another objection that has been raised to the "extrinsic" theory concerns the possible increase in the intraocular pressure during accommodation. Obviously there should be very little if any variation. The act of accommodation does not mean any

change in the quantity, but merely a rearrangement of the contents within the eyeball. The grand piano or the kitchen stove can be moved around within the room without increasing the pressure upon the outer walls. We have seen thruout the animal series, as well as in the structure of the human eye, that nature has made ample provision for the rapid shifting, or interchange, of intraocular fluids between the anterior and posterior segments. Much laborious research, with more or less contradictory results is revealed by looking over the literature upon this phase of our problem. Some observers, among them Sattler[30], report definite increase of tension within the vitreous upon stimulating the ciliary muscle, while others agree with Hess that no such increase can be demonstrated.

Hess was not convinced that pressure by the vitreous against the lens constituted the mechanism of accommodation in birds' eyes until, by the use of a micromanometer of very great sensitiveness, he was able to measure this increase. Is it possible that he failed to find this evidence in monkeys', or in human eyes, because an instrument sufficiently delicate to record definitely the slight, momentary change, under normal conditions, was not available?

DISPLACEMENT OF LENS BY MYOTICS.

We may now refer to certain clinical experiences which demonstrate that the vitreous is pushed against the lens, as clearly as if it had been recorded by a manometer; and yet were noted under conditions where there was no appreciable change in the intraocular tension. They refer to the behavior of subluxated lenses, following the more or less prolonged use of myotics.

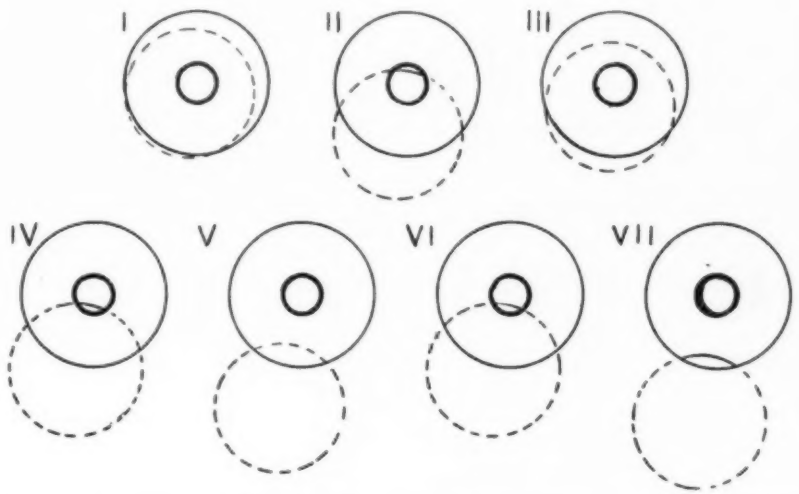

Fig. 6. Diagram of changes in position of subluxated lens in Case 1 under pilocarpin. I Primary Position of lens. II After pilocarpin instillations for ten days. III Pilocarpin suspended one week. IV After ten months daily instillation of pilocarpin. V After fifteen months policarpin. VI Pilocarpin omitted for two days. VII Four days after resuming pilocarpin instillations.

When zonular fibers are uniformly intact, the vitreous pushing against the lens produces well balanced, uniform changes in the form of the lens. What would happen if a considerable segment of the zonula were missing? Manifestly, lenticular refraction would be irregular, which is exactly what we find it to be in cases of subluxation of the lens. Under the laws of surface tension the lens assumes a more spherical form and thus usually we find a degree of myopia, but it is so irregular that satisfactory correction with glasses is difficult, if not impossible. More often such patients get along better with correction for the aphakial portion of the pupil, if that is available.

Much more interesting is the effect of myotics on the position of these dislocated lenses. With the zonula intact, there would be no lateral displacement of the lens when the vitreous is pushed against it; but if a large segment of the zonula were defective, pressure of the vitreous would result eventually in pushing the lens away from that segment, in the direction where the attachments remained intact. This appears quite natural and reasonable, but the result was entirely unexpected in the first case where this phenomenon was noted. No similar observation had been recorded in ophthalmic literature. It is not surprising, therefore, that this shifting of position in subluxated lenses, under the continuous use of myotics, was not anticipated.

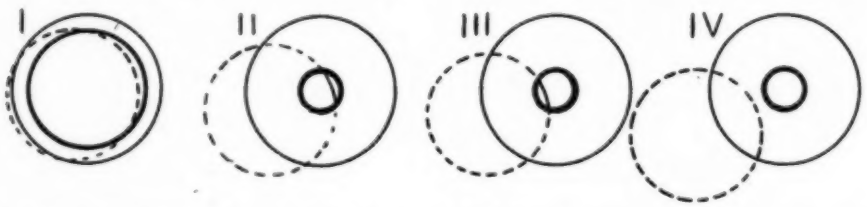

Fig. 7. Changes of position of the subluxated lens in response to pilocarpin. Case 2. I. Position of lens with pupil dilated by homatropin. II. Position twenty hours after instillation of pilocarpin. III. Position of lens next day after repeated instillations of pilocarpin. IV. Position after two weeks instillations of pilocarpin twice daily.

In the first case both eyes showed a slight dislocation downward of the lens, which could be recognized only when the pupils were dilated. Some weeks after the case was first seen the lens in the right eye slipped into the anterior chamber. As suggestions for immediate operation were refused by the mother, an attempt was made to return the lens to its former position by medical and postural therapy, with success. To prevent a recurrence of this accident, the regular and continuous use of pilocarpin solution daily was advised for both eyes, with the result shown in the accompanying diagrams. Both lenses disappeared below the lower margin of the pupils, permitting a perfect correction for vision thru the aphakial pupils, and establishing a most satisfactory condition for the patient.

One might consider in this case the possibility of relaxation of the zonula, and a dropping downward of the lens in response to gravity, facilitated by the use of myotics. But these lenses were not loose and mobile. These were held in position below the pupil under myosis, and did not move about with vigorous movements of the eyeball; showing that it was something besides relaxation of the zonula that caused them to assume this position. Any doubt remaining, as to the exact cause for this shifting of the position of the lenses in the first case, was eliminated in the second case. Here the defect in the zonular attachments was on the nasal side. When myotics were used the lens moved from beyond

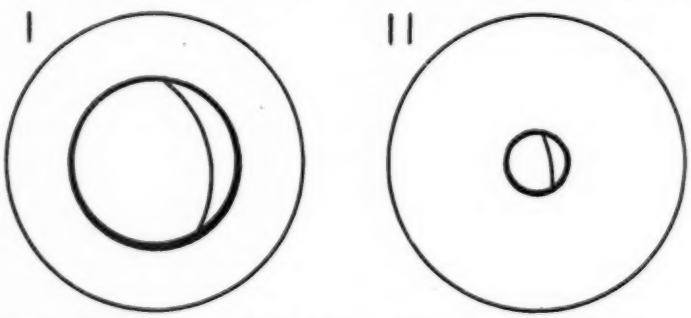

Fig. 8 Traumatic dislocation of lens. Smaller circle margin of pupil; arc within, edge of lens. I. Pupil dilated by euphthalmin. II. Pupil contracted, after eserin.

the nasal edge of the pupil, and disappeared behind the temporal border, after a few weeks. The striking manner in which the nasal equator of the lens pushed across the pupil to the temporal margin and finally disappeared behind it, could not be explained except by the action of the vitreous against the lens.

In the third case another bit of evidence was collected, due to an accidental defect in the iris structure. In this case the lens had been spontaneously loosened some twelve years before. With movements of the eyeball it floated upward, until checked by remnants of zonular attachment below. These movements were readily seen and followed with the ophthalmoscope. The vitreous had become cloudy, possibly as a result of years of trauma from the floating lens. After the use of the myotic this lens was visibly held fast, below the lower margin of the pupil, and could not be dislodged even by vigorous movements of the eyeball. Furthermore, a tiny bead of vitreous protruded into the anterior chamber, thru the defect in the structure of the iris in its lower segment. After several jerking movements of the eyeball this bit of vitreous was drawn backward; but the lens was still held in situ, until the effect of the myotic had passed off.

The detailed clinical history of these cases was presented at the meeting of the American Ophthalmological Society, 1925[31]. Suitable cases for such observations are not often encountered. In one case that was observed recently there had been a traumatic dislocation many years ago. The lens was loosened on the nasal side. Both iris and lens were tremulous. Under the influence of myotics the lens would move definitely toward the temporal side. The patient was an old man of irregular habits. The myotic was not used with sufficient constancy to secure the best results. When last seen, two months ago, the nasal margin of the lens had nearly reached the temporal border of the pupil, with great improvement in vision. No further factor, except the pressure of the vitreous against the lens in response to the ciliary spasm excited by the use of myotics, can account for these changes in position of dislocated lenses.

Evidently, this is just touching the edge of a large field, offering enticing opportunities for research and for the logical correlation of facts. For example, the possible interpretation of pathologic intraocular pressure, in relation to this conception of the mechanism of accommodation, is worthy of the most careful consideration.

In conclusion we may state that the phenomena of accommodation have been shown to be susceptible of explanation by the "extrinsic" theory. Details may be modified by further knowledge; but the underlying principle, as v. Pflugk and Tscherning have stated, is probably the same for birds and mammalia. If true inherent elasticity of the lens is ever demonstrated, it can be fitted into this scheme as an adjunct to what has already been shown to exist. But there is no occasion to imagine it, in order to explain observations not otherwise understood.

Recently Fincham using the best modern methods for his measurements concluded that there is a relative flattening of the periphery of the lens during accommodation, but that the amount varies in different individuals. Fincham attempts to account for this flattening by increased elasticity in the peripheral zones of the anterior capsule, released by relaxation of the zonula according to Helmholtz. Having demonstrated elastic fibers in the lens capsule by staining methods and finding the anterior capsule thicker in the peripheral zone, he freely assumes the rest.

Review of other vertebrates shows, that the elastic fibers found in their lens capsules cause the lens to return to its natural shape after being deformed by external forces. That corresponds to the action of elastic fibers in other tissues. Why then should we assume on the contrary, that in the human eye elasticity waits perpetually, like a coiled spring under tension, for muscular action to relax it?

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TREATMENT OF TRACHOMA BY INTRAMUSCULAR INJECTIONS OF MERCURY.

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The use of mercuric salicylat in this way has been tried, as suggested by Ferguson. In five cases, that did not yield to the ordinary agents, freedom from symptoms was secured, in a comparatively short period, by this treatment. Read before the Ophthalmic Section, St. Louis Medical Society, April, 1926.

Trachoma is an ancient disease. For centuries it has been known and at times it has amounted to a veritable scourge. Ceaseless search for a cure and unnumbered remedies, both medical and surgical, employed, leave us still seeking and trying to find the undiscovered cure.

Comparatively few reports have appeared for treatment other than that applied locally. Several attempts have been made to develop a vaccine, or immune serum. Blatt[1] in 1920 reports a large series of cases in which parenteral injections of milk were employed with not one cure attributable to the milk. Sedan[2] reports one case of trachoma treated actively for three years with only fair results. At this time the patient contracted lues and was given potassium iodid, mercury cyanid and neosalvarsan. Immediate improvement of the trachoma followed. Which of the three agents, if any, brought about the good results no one can positively say.

At the meeting of the Section on Ophthalmology of the American Medicad Association in 1924 Dr. Harvey J. Howard[3] of Peking, China, reported verbally on a treatment offered by Mr. Ferguson of London for trachoma by intramuscular injections of mercuric salicylat in one grain doses. The results reported by the English clinics were so favorable that much interest was aroused.

Upon this suggestion the treatment of a few cases by this method was undertaken. These cases were chosen for this treatment largely because they were severe cases of long standing that had become worse in spite of active treatment by other methods. The new treatment was undertaken as a sort of forlorn chance that something might come of it. No case was subjected to this treatment that had not failed to respond to the ordinary agents and in all instances the regular treatment by other means was continued so that the only change was the addition of the mercury injections. The first cases were given mercury salicylat in one grain doses but this was varied according to convenience, some receiving mercury bichlorid 1/12 gr. given in the routine followed in the treatment of syphilis. Instead of being confined to a course of eight doses the treatment was extended over a prolonged period and in one instance was repeated on two or more subsequent occasions following recurrence or exacerbation of symptoms.

To date five patients have been treated for periods long enough to determine whether or not good would follow. In each of the five cases there has been a marked clinical improvement in the signs and symptoms of the disease within a comparatively short time after beginning the injections. Three other cases are now being given the treatment. One is improving. The others have not continued sufficiently to show results.

CASE I. Male, age 20.. History of trachoma in Europe, treated, and clinically well enough to pass the immigration authorities two years ago. When first seen he had a keratoiritis of three days' duration. Treatment with atropin, salicylates, heat. Sphenoidal sinusitis discovered and treated by Dr. H. W. Loeb. In the course of four weeks treatment the iritis cleared, ulcers of the cornea developed and healed but the lids became and remained thick and beefy and the cornea was vascular above. Vision 15/20 right and 15/12, left. Local treatment with copper sulfat solution and crystal and other measures resulted in no improvement and after six weeks an ulcer again developed, so severe,

that he was sent to the Jewish Hospital for treatment. Two weeks stay in the hospital with constant treatment with local measures led to healing of the ulcers but the lids remained thickened and red. Now after a total of ten weeks mercury salicylat in one grain doses was given intramuscularly at three day intervals for three doses, then in weekly doses for five weeks. In the course of three months he had one ulcer followed by constant improvement to fairly satisfactory state.

After remaining in comparative comfort two months he suffered a relapse of increasing severity for three weeks when he was again hospitalized for daily injections of mercury. Prompt improvement for sixteen days when he left the hospital with ulcers healed, cornea still cloudy and lids much better.

The condition of the right eye continued to improve and has remained quiet to date, about one year later. The left eye was practically well on leaving the hospital but two months later the lids became thick and red and moderate photophobia developed, but the cornea is clear and the vision normal.

Case II. R. V. Male. Age 26. Seen at W. U. D. Sept. 10, 1923. History of emery dust in right eye six weeks before. OD. V. = 20/48; OS. V. = 20/12. Lids thick, red, and pannus formation right cornea. Treated twice and three times weekly with copper crystal; Prince's solution, etc.; sphenoidal and ethmoidal sinusitis found and operation performed; six months later still unable to work, sent to hospital for grattage March, 1924. Treatment continued till Aug. 22, 1924 (4½ mos.) when he tried working, being treated by his wife, and returning in four months (Jan. 1925) much worse. After ten days so much discouraged he was sent to the government trachoma hospital where he had grattage and treatment for seven weeks, returning March 9, 1925, worse than when he left. Moderate improvement for two weeks. On March 27, 1925 was referred to the skin clinic with request for mercury injections. Given Hg. Cl_2 twice weekly for twenty doses. In two weeks there was marked improvement and in four weeks he was able to go to work and has been working since. Reports received thru Social Service worker but patient not seen for one year.

Case III. G. E. S. Male. Age 60. Seen 5/13/25. History of sore eyes for two and one-half years. Ulcer seven weeks. In great pain with intense photophobia, ulcers of both corneae, thick pannus, lids trachomatous. Treated in Jewish Hospital for one month with local applications, improved and went home to return in three weeks with condition worse. Local treatment and mercury intramuscularly. Much improved and sent home, four weeks later where local physician continued mercury and treatment. Recently eyes are quiet and the patient sees better than he has for long while.

Case IV. G. M. Male. Age 35. Seen 4/16/25. History of injury, foreign body in right eye two months before. Lacrimation, photophobia, lids swollen, conjunctiva thick, scars of trachoma upper lid, pannus with healed ulcer. OD. V. = fingers at one foot. OS. V. = 15/16. Local treatment with moderate improvement for three months. July, 1925, mercury injections twice weekly. In three weeks lids almost free from granulations. In four weeks (8/7/25) OD. V. = 15/50. In March, 1926, practically no sign of active trachoma. Scar of cornea remains.

Case V. Hy. M. Male. Age 33. Seen August, 1922. Ulcers both corneae. Granulated lids. Treated one year previously. Treated continuously with indifferent results, frequent recurrence of ulcers and increasing scarring of cornea. Vision August, 1922. OD. V. = 15/16; OS. V. = 15/20. Vision August, 1925. OD. V. = 15/250; OS. V. = 15/200.

September, 1925, ulcer left and marked redness and tearing both. Treatment with mercury salicylat given by family physician. In three weeks ulcers do not stain. Very little irritation. March 9, 1926, cornea

clearer, lids bleach readily and are much smoother. This is the longest quiet has been maintained in three and one-half years; permanency of cure still open to question.

SUMMARY.

Five cases are here presented in some detail. Each of these resisted treatment by local measures for prolonged periods, each is characterized by severity of symptoms and each became practically free from symptoms in a comparatively short period after receiving mercury intramuscularly. Three other cases under observation with similar history are improving rapidly.

How the mercury acts in producing the improvement, if it does so act, we have no theory to explain. We hope to be able later to report a larger series and to see the method tried by others.

900 *Carleton Bldg.*

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MELANOSARCOMA OF CHOROID, SYMPATHETIC OPHTHALMIA AND RETROBULBAR NEURITIS.

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A man of thirty-eight came, with inflammation and increased tension of his right eye. Under miotics tension became normal but the left eye developed symptoms of sympathetic ophthalmia. The right was enucleated, and contained a choroidal sarcoma. Tonsillectomy and drainage of the nasal sinuses was followed by rapid recovery. The conditions found in the enucleated eye are reported in detail. The tumor was almost entirely necrotic. The choroid presented diffuse proliferation of chromatophores, infiltrating lymphocytes, plasma cells and great numbers of epithelioid cells—lesions found in an eye causing sympathetic ophthalmia. Read before the Ophthalmic Section, St. Louis Medical Society, October 24, 1926.

The subject of this paper presents a most unusual combination of circumstances wherein the provisional and succeeding diagnoses are shown in contrast against a sharply defined clinical picture. He is a white married male, thirty-eight years old, whose occupation is that of chauffeur.

During the midde of October, 1925, his right eye became inflamed and there was a sensation of thumping over it as tho a hammer was striking his head. Headaches were severe and he used various home remedies for their relief along with divers substances applied to the eye. Four weeks later he was seized with dizziness and vomiting which lasted for two days, whereupon he consulted his family physician who prescribed pills and drops for the eyes.

On November 23, 1925, he was admitted to Washington University Dispensary. The right eye was painful, prominent and showed a dense circumcorneal injection. The iris was dull and lusterless with a pupil obscured by a muddy yellowish-gray material, posteriorly placed. Tension was slightly raised, and a tentative diagnosis of hemorrhagic glaucoma was made, after various other possibilities were discussed and rejected. The left eye was highly myopic. The patient was sent into Barnes Hospital where he was treated with hot applications and myotics for one week.

He felt better, but while the tension came down, apparently to normal, there was no marked improvement clinically, in this eye. Treatment and observation in the clinic continued for a month after this, and then one day he came in with a lowered vision, photophobia and other signs of an iridocyclitis in the other (left) eye. A diagnosis of sympathetic ophthalmia was made by his attending surgeon who advised an enucleation of the right eye which was done immediately.

After formalin fixation, this eye was opened and found to contain a large

sarcoma of the choroid which was later confirmed by the microscope. The left eye showed some improvement, and while our clinicians felt that his chances for immediate complete recovery were excellent, there was not the rapid convalescence which usually attends enucleation for sympathetic ophthalmia. Over the course of another month during which period he was observed three times each week and given standard treatment for his ailment, the iridocyclitis continued in his remaining eye and vision finally dropped to 4/120.

About this time I was requested to see him on my service, and the first thought was to determine the agencies which were keeping up the irritation. Altho he had had a complete physical examination including every possible phase, all of which were negative, I insisted that he be again examined. Pus was found in his tonsils and they were removed the day of the examination, about March 24, 1926. Nose, teeth, body and serologic tests were all reported negative. The ophthalmoscope showed a neuroretinitis with cloudy aqueous. Following tonsillectomy the vision rose to 20/120 but fluctuated daily.

On April 1, 1926, this patient was observed at my office, where a rhinologist also saw him and made a diagnosis of bilateral ethmosphenoiditis. Under local treatment for this condition for six days, there was rapid marked improvement in his vision and operation was advised. Five days later, both sphenoid sinuses were widely opened, with vision 20/38 on April 12. On the fourteenth, seven teeth were removed and since then his complete recovery has been swift and gratifying. On my last examination of him, June 16, 1926, he saw 20/15 with — 6.5 sphere ⊂ — 2. cylinder axis 180°, which was prescribed.

COMMENT.

The tension of an eyeball may be affected by an intraocular tumor, and in doubtful cases may serve as an indication, diagnostically, of the presence of tumor. In the earlier stages of tumor tension is normal, but later on it increases, while in the further growth of the mass sudden increase of tension may set in at any time. Elevated tension may be seen with relatively small tumors, while on the other hand a tumor may have filled up a large part of the eye without exciting any glaucoma symptoms at all.

The causes of rise in intraocular pressure are variable. Parsons explained the glaucoma thru a blocking of the angle of the anterior chamber due to forward pressure of the lens, iris, etc., but goes on to say, that the situation of the tumor is of importance for it may be such as to obstruct the exit of blood by the veins. The angle also, not uncommonly, becomes blocked by pigment cells.

Increase of the intraocular contents does not adequately explain the rise in tension, for the additional space taken up by the tumor is balanced by a decrease in the mass of the vitreous. Responsibility for sudden attacks of glaucoma often seen with intraocular sarcomata may be laid to destructive hemorrhages as pointed out by Verhoeff.

The differentiation, clinically, between acute inflammatory glaucoma, as we have it here, and sarcoma of the choroid is difficult, and may be impossible, for the picture presented by the affected eye corresponds completely with the complex of symptoms of inflammatory glaucoma. Many the eye upon which an iridectomy had been done previous to enucleation, which then revealed the true cause for the increased tension, intraocular tumor. We could never obtain a view of the interior of this patient's eye because of complete obstruction of the pupil by material which later proved to be inflammatory exudate.

In rare cases the inflammatory stage of tumor growth does not present the symptoms of glaucoma, but rather of a severe iridocyclitis often accompanied by chemosis and exophthalmos, when the inflammation is especially violent. Inadequate nutrition is apt to produce partial or complete necrosis of an intraocular tumor, with a result like this. Melanosarcomata are the

chief malignant tumors found within the eye, are almost invariably primary and develop from the outer choroidal layers, with inward growth and subsequent retinal detachment.

There is not much in the literature regarding the presence of giant cells in intraocular sarcoma, altho Ernst Ziegler states that in both polymorphous and spindle cell types there may be more or less numerous giant cells present, so that the designation "Giant-Cell Sarcoma" may be applied; and while these arise from the long bones particularly, they may be found in other places. Giant cells have been described in a few cases by Nettleship, Hirschberg and Poncet. Two cases in children, aged four and two, were noted by Nettleship and Hirschberg respectively, and were probably tuberculous. Poncet's case showed advanced degenerative changes and was probably of the same type. Multinucleated cells are not uncommon in sarcomata but usually differ much from ordinary giant cells. They are evidence of rapid nuclear division.

The diagnosis of intraocular sarcoma, at any time, is difficult. To say that a given picture is that of sarcoma is not an easy matter. Some are too prone to assume entirely too much, by a casual glance within an eye, and then say sarcoma. A careful and conscientous clinician will differentiate it from iridocyclitis, retinal detachment, choroidal detachment, neuroepithelioma of the retina, carcinoma of the choroid, cysticercus, glaucoma, choroidal exudation and pseudotumor.

In sympathogenic (first) eyes, a study of the pathology reveals an infiltration of a large part of the uveal tract with small mononuclear cells (lymphocytes), characteristically grouped around the blood vessels, nodal in character; which may fuse into general lymphocytic thickening with groups of epithelioid and giant cells. A layer of shrunken pigmented connective tissue may replace this infiltration layer, with hyaloid degeneration of the blood vessels. The free surface of the iris and ciliary processes almost always presents a fibrinoplastic exudate.

Parsons states that the changes found in the choroid in sympathetic ophthalmia are essentially those of chronic choroiditis, but they sometimes show characteristic differences. The same changes have been observed in the few cases in which the sympathizing eye has been examined. A marked tendency to unusual cell proliferation and the formation of giant cells which are found in the neighborhood of the larger vessels is observed by Schirmer, who likens the histologic appearance to tubercle. The second edition of Collins and Mayou stresses the presence of numerous nodules composed of mononuclear lymphocytes, plasma cells, epithelioid and giant cells.

Bailey, Ruge, Uhr, Fuchs, Brown and others agree in their researches concerning the microscopic picture in sympathetic ophthalmia. Fuchs, however, adds the conclusion that the somewhat nodular lymphocytic infiltration, with the tendency to production of epithelioid and giant cells is absolutely characteristic of this disease; and also that the fibrinoplastic inflammation, which is practically always present, does not necessarily belong to sympathetic ophthalmia proper, but is due to a secondary mixed infection.

The majority of subsequent observers agree with his first contention, but their negative results as to the occurrence of sympathetic ophthalmia without the typical picture cannot be held to disprove the positive results of Ruge, Gilbert, Watanabe and others, who have found intermediate forms between the typical sympathogenic inflammation and that which occurs in nonsympathogenic eyes.

Fuchs himself admits that both giant cells and epithelioid cells may be lacking in sympathogenic eyes, and that in the early stages the only characteristic thing is the nodal infiltration with lymphocytes. This observation has also been made by other men in nonsympathogenic inflammations, including anaphylactic reactions and the inflammations produced by Guillery with various toxic products.

An important fact that we owe to Fuchs, is that typical sympathogenic

changes have been recorded by Bottera and Meller in eyes which have never been subject to serious injury, and where nothing in the history would ordinarily raise the question of sympathy. These eyes have generally shown the type of disease known as chronic iridochoroiditis, or malignant uveitis, in which general results suggest the sympathetic form of uveitis. This, together with the occurrence of sympathetic ophthalmia with sarcoma of the first eye, led Meller to produce his endogenous theory, according to which such cases are due to the same germ which causes sympathetic ophthalmia, invading the body thru some other means than by way of an injured eye.

Quite a number of cases of sympathetic ophthalmia from intraocular tumors have been reported; and while some of them were merely sympathetic irritation and others simple papillitis due perhaps to the carrying over of toxins, some eight cases of the thirty collected by Schirmer, with Fuchs' three and Meller's one, have been true sympathetic ophthalmia; due, not to the tumors as such, but to an endogenous infection of the tumor eye, the inflammation spreading from this to the second eye. In all such cases however, it must be remembered that an equally applicable theory is, that both eyes were infected from the same endogenous source. There is no argument against the possibility, that an endogenous infection may start in one eye and spread to the other by one of the various channels which are open.

It was in 1893 that Ziem laid stress on the influence of the nasal cavities in eye diseases and reported several cases of sympathetic irritation cured by intranasal treatment. Also, Everbusch noted that sympathetic ophthalmia is apt to become worse with attacks of nasal congestion, and to improve upon removal of turbinate hypertrophy.

Of the older authorities, no one has claimed that germs associated with focal infections might be the cause of sympathetic ophthalmia, but it is not improbable that these organisms with their toxins might prepare the eye for the invasion or action of other bacteria, particularly the organism of sympathetic ophthalmia, or might contribute to the violence of its action. E. V. L. Brown reported improvement in sympathetic ophthalmia following removal of infected tonsils.

The following report on the gross and minute pathology of the case discussed herein, is by Dr. Harvey D. Lamb, who examined sections of the enucleated eyeball.

PATHOLOGIC REPORT.

The excised right eyeball was fixed in 10% formalin.

The globe was bisected about its middle by a section in about the vertical meridional plane. The surface of this section measured 21 mm. anteroposteriorly, by 20 mm. vertically. These dimensions are smaller than normal, even allowing for the shrinking in the fixative.

Macroscopically. The cut section showed the cornea and sclera thicker than normal, particularly in the posterior half of the sclera. The thickness of the sclera adjacent to the optic nerve is about 2½ times that of normal for the same situation; the thickness just above the optic nerve is about 1½ times thicker than that just below the nerve. The anterior chamber is present only peripherally, for the lens has been pushed far forwards, carrying the iris with it until the latter has come in contact with the cornea. A yellowish-white mass occupies the superior and nasal parts of the vitreous chamber. Anteriorly this mass is in apposition with the lens; superiorly and posteriorly it is lined by a dark brownish colored layer. The retina is completely detached.

The two approximate temporal and nasal halves of the globe were dehydrated in the alcohols; one half was imbedded in celloidin and the other half in paraffin; sections from each imbedded half were cut and stained in solutions of hematoxylin and eosin.

Microscopically. The cornea shows many small capillaries in its peripheral parts. In its central portion it is

closely adherent posteriorly to a very thin atrophic iris remains which separate it from the anterior lens capsule. The conjunctival tissue adjoining the limbus shows many new formed capillaries and new connective tissue fibers, containing young fibroblasts and infiltration with varying numbers of small lymphocytes and plasma cells. At the inferior side, there are signs of a marked edema having been present

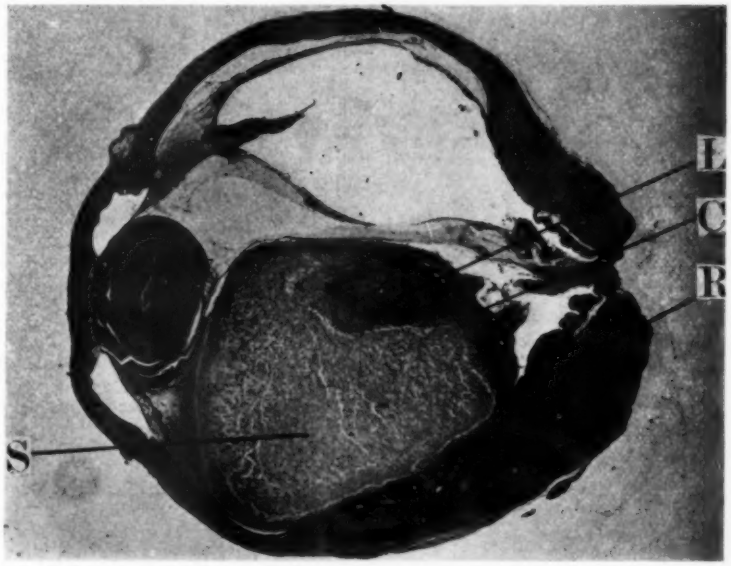

Fig. 1. Vertical section thru middle of eyeball. S. Necrotic mass of choroidal sarcoma. L. Living tumor cells. C. Inflammatory exudate around tumor. R Choroid thickened, with sympathetic infiltration.

just beneath the conjunctival epithelium, for the latter has been pushed far anteriorly a short distance at the limbus corneae.

The iris is markedly atrophic, particularly in that part lying in contact with the cornea and lens. Here the iris is reduced to a very thin membrane of connective tissue, showing in its meshes many scattered pigmented cells, derived from the totally destroyed posterior pigmented epithelial layer of the iris. On the superior side, the posterior pigmented epithelial layers are well preserved near the base of the iris. There is much sclerosis in all except the extreme peripheral portions of the iris. A thin dense layer of connective tissue is generally present along the anterior surface of the iris in those parts peripheral to the lens. This part of the iris contains many small, new formed capillaries, pigment bearing and nonpigmented chromatophores, small lymphocytes plasma cells and a few loose pigment epithelial cells. All these cells are rather diffusely and thinly scattered thru the iris stroma. Some of the larger capillaries contain many polymorphonuclear leucocytes, in the peripheral parts of the blood stream.

On the anterior surface of the iris peripheral to the lens there is a thin layer of hemorrhage containing a few large mononuclear leucocytes and large lymphocytes. The anterior chamber is otherwise empty.

The base of the iris is everywhere pushed forwards against the cornea, entirely preventing aqueous humor from entering the filtration spaces. The meshwork shows many small capillaries, in its midst, and a light diffuse infiltration with small lymphocytes. Many small blood vessels appear in the sclera, just external to the ligamentum pectinatum; many of these vessels show thin coatings with small lymphocytes.

The lens shows good preservation of the capsule and the anterior epithelium. There are present many fine

vacuoles in the cortex, characteristic of complicated cataract. A thin layer of liquefied lens fibers is present in the anterior and lateral portions of the lens, just beneath the epithelium.

The ciliary body shows a very marked atrophy with disappearance of much of the oblique and circular bundles of the ciliary muscle and much of marked edema having been present between the ciliary muscle bundles on the inferior side. The epithelium on the inner surface of the ciliary body has been much disturbed by the inflammatory exudate lining it internally. The unpigmented ciliary epithelium has largely disappeared, and the pigment ciliary epithelium is in most

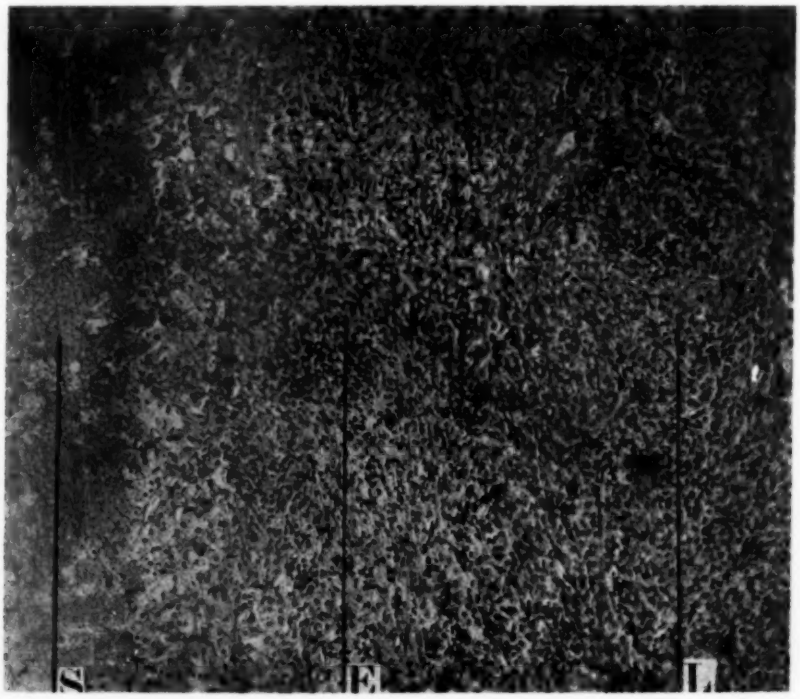

Fig. 2. Section thru portion of sarcoma. S. Necrotic mass of tumor. E. Inflammatory exudate extending around tumor mass. L. Living tumor cells.

new formation of connective tissue in their place. This sclerosis is also present in quantity in the anterior portion of the stroma, and in what is left of the ciliary processes. A large part of this new formed connective tissue in the ciliary body is hyalin. There is present among this connective tissue many new formed capillaries, containing in the periphery of their lumina many polymorphonuclear leucocytes. A rather diffuse infiltration with small lymphocytes and a few plasma cells are seen. Some very large cells, staining faintly blue, are seen, with small poorly staining nuclei. They are probably degenerative derivatives of plasma cells. There are present signs places broken up into single round or oval pigmented cells, or small groups of several pigmented cells.

The inflammatory exudate on the superior side entirely fills in the space between the iris, ciliary body, tumor mass and lens; on the inferior side, the exudate begins as a thin layer on the inner side of the ciliary body in front and gradually thickening posteriorly extending as far as the limits of the ciliary body. Anteriorly the exudate consists mainly of fluid, most of which contains coagulated albumin. Many single cells from the pigment ciliary epithelium as well as small lymphocytes, large mononuclear leucocytes with many transitional forms, plasma

cells, and a few large lymphocytes and polymorphonuclear leucocytes, are present, scattered diffusely about. On the superior side there are many single connective tissue fibers forming a kind of network in the fluid exudate; scattered about in this network are a few young fibroblasts with fine processes from the cell bodies. Posteriorly the exudate is a dense fibrocellular structure extending as far as the posterior limits of the ciliary body. It is thickest anterior to the tumor and on the inferior side of the eye. Much of the connective tissue is hyalin; there are many capillaries, formed and forming, in the exudate. The infiltrating cells are small lymphocytes, plasma cells, large mononuclear leucocytes, young fibroblasts, epithelioid cells and a few plasmacytoid and giant cells. Close to the tumor there are present in the exudate many pigmented sarcoma cells.

The choroid shows generally a gradual denser cellular infiltration as one examines it anteriorly to posteriorly. The choroid maintains about a uniform thickness on the side opposite the tumor; on the side of the tumor it is a dozen to fifteen times thicker than normal, but it becomes thinner again posteriorly. There is much sclerosis on the superior side, adjoining the tumor; most of this connective tissue is hyalin. In the thickest part of the choroid on this side there is a very dense generally diffuse accumulation of pigment sarcoma cells. These pigmented sarcoma cells occur in a thinly diffused quantity thruout the choroid adjoining the tumor. On the opposite side, there is seen a diffuse proliferation of chromatophores in the choroid.

The infiltrating inflammatory cells in the choroid are small lymphocytes, in the great majority, but there are a few plasma cells in groups; in the anterior portions of the choroid the lymphocytes occur in foci, posteriorly they appear diffusely accumulated. Epithelioid cells occur in great numbers, either diffusely scattered among

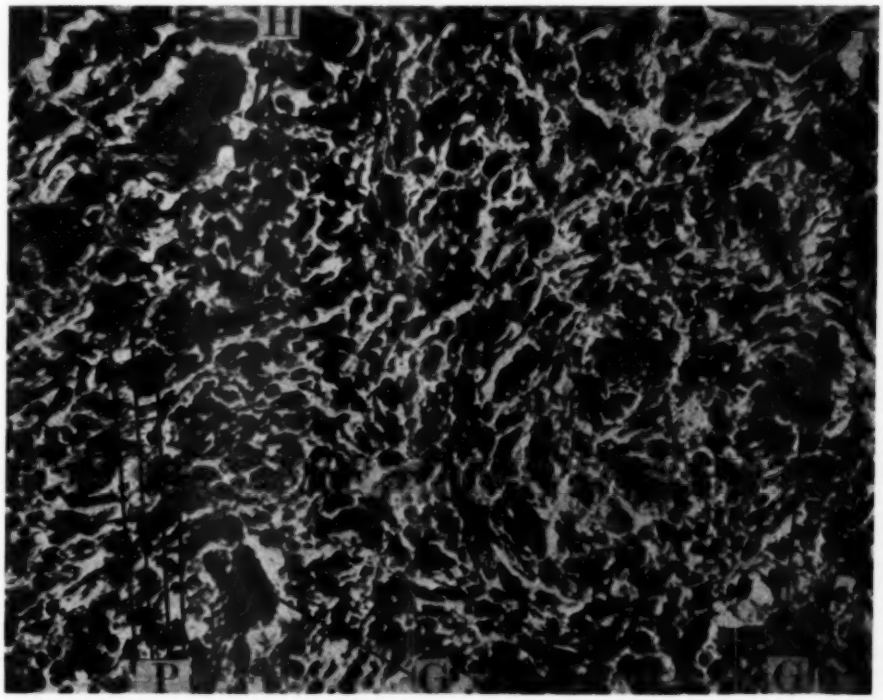

Fig. 3. Section thru portion of sympathetic infiltration in choroid. H. Small lymphocytes. P. Pigmented epithelioid cells. G. Pigmented giant cells.

the lymphocytes, or in island groups surrounded by or even apart from the lymphocytes; many pigmented epithelioid cells are seen adjoining the tumor. Giant cells are quite common among the epithelioid cell groups, particularly on the tumor side, many of them on this side are pigmented. The choriocapillaris and the lamina vitrea are well preserved; particularly where the cellular infiltration is thickest. There is not the slightest exudate anywhere on the inner side of the choroid, or pigment epithelial layer between the choroid and retina. The pigment epithelium between choroid and retina has disappeared in many places. On the inferior side this layer has become detached with the retina.

The tumor mass is almost entirely necrotic; to the nasal side, where the tumor is thickest there is seen internally a large mass of living tumor cells. These cells are large round or oval cells, some of which are pigmented. This mass of living sarcoma cells lies in a thick layer of fibrocellular exudate continuous with the choroid, posteriorly and anteriorly, with a much thinner exudative layer extending around anteriorly. Much of the connective tissue in the exudate is hyalin. The cells in the exudate are small lymphocytes, large round or oval sarcoma cells, epithelioid and a few plasma and giant cells. Posteriorly near the junction of this exudative layer with the choroid, many of the epithelioid and giant cells are pigmented.

The completely detached retina shows an extreme degree of degeneration and even destruction. Closely adherent to the tumor on the superior side, its identity is soon lost as one goes anteriorly; it was evidently destroyed early by the exudate on the inner side of the tumor. On the inferior side, the retina has been split by the exudate lining the inner surface of the ciliary body. Both portions of the divided retina are of greatly irregular thickness. Each consists of vacuolated remains of retina with many neuroglia cells and a few nuclear cells diffusely scattered; the inner portion contains many large capillaries, the outer portion contains many scattered round pigmented cells derived from the pigment epithelium. Just anterior to the optic nerve, the retinal folds show fair preservation of the outer nuclear layer, proliferation of neuroglia cells and considerable sclerosis in the inner layers of the retina. This connective tissue has evidently originated from the bloodvessels which are quite large here. Much of this connective tissue is hyalin.

The optic nerve has been pulled far forwards thru the scleral canal by the detached retina. The optic nerve shows much disappearance of nerve fibers and the presence of much hyalin connective tissue in bands running anteroposteriorly.

All the emissary bloodvessels and nerves in the sclera show extensive cellular coverings. Anteriorly the cells are largely small lymphocytes, but interspersed with many plasma cells; in a few places the plasma cells are in the majority. Posteriorly, also, the coverings are largely lymphocytes, but mingled with many epithelioid cells.

DIAGNOSIS: *Necrotic large round cell melanosarcoma of the choroid and sympathetic choroiditis.*

SUMMARY AND CONCLUSIONS FROM THE PATHOLOGIC STANDPOINT.

There was primarily present in this eye the large round cell melanosarcoma from the choroid. When the neoplasm attained a large size it increased the intraocular tension, pushed the lens, ciliary body and the iris forwards and thus closed the iris angle

Atrophy with sclerosis of the iris and ciliary body resulted partly from stretching of these structures and partly from interference with the inflow and outflow of blood, dependent upon increased intraocular tension. Probably from this blocking of the circulation the tumor became necrotic. Atrophy of the ciliary body was followed by diminished secretion of the aqueous humor, diminished tension to below normal and consequent thickening of the cornea and sclera.

The inflammatory exudate from the iris and ciliary body, that around the tumor, and the sympathetic choroiditis are fairly recent. The fact that the iris and ciliary body do not contain any cellular infiltration to speak of, is probably due to the atrophic conditions of these structures when the latter inflammation started. The inflammatory exudates from the iris and ciliary body are more pronounced on the superior or tumor side, to say nothing of the thick layer of exudate on the anterior, posterior and internal surfaces of the tumor. This would clearly indicate that the necrotic tumor must have been, at least partly, the cause of these exudates. Such exudates are not seen ordinarily about choroidal sarcomas.

It is therefore not forcing conclusions when we say, that toxins from the necrotic sarcoma caused a reaction from the uveal tract, resulting in these exudates and in the sympathetic choroiditis. As the result of such reaction from the uveal tract of one eye, substances could be easily produced, which carried in the blood to the other eye, would sensitize its uveal tract. Then, when the toxins came from the sinus trouble thru the blood, the sympathetic uveitis would be lighted up in the second eye.

The microscopic findings show a secondary glaucoma, due to blocking of the filtration angle thru the anterior dislocation of the internal ocular structures, which substantiates the admitting diagnosis. That this condition is secondary is proven by the presence of an intraocular melanosarcoma of the choroid, partly atrophic and necrotic, which caused the dislocation of the structures and which also contributed to the increased pressure by blocking of the blood vessels. They further show the clinical diagnosis of sympathetic ophthalmia to be correct, as all the necessary elements for this condition have been noted in the sections.

The literature shows cases where sarcomata have caused sympathetic ophthalmia. Now, in the absence of history of injury in the sympathogenic eye we can assume that the sarcoma was essentially the exciting factor in the production of sympathetic ophthalmia. But whether this was due to the tumor itself, or instigated by the generation of toxins from it, I am unprepared to say.

Granting then that we have here an authentic case of sympathetic ophthalmia, how are we to explain the conditions following enucleation of the sympathogenic eye; namely, an aggravated postoperative iridocyclitis and neuroretinitis, which grew steadily worse; and which cleared up only after all sources of infection were eliminated? The remaining eye became more quiet immediately after the tonsils were removed; but continued in all its malignancy again, until the sinuses were drained, and only then did it subside, and rapidly.

Numerous cases are known where the sympathizing eye was lost after enucleation of the first eye, even tho such a procedure was timely, and in the absence of a possible route or means for the introduction of a specific organism in this particular case, I cannot conceive of anything else except that sympathetic ophthalmia depends not so much upon injury of the sympathogenic eye itself for its development, but that its manifestations are due to some initial process remote from either eye but directly influencing it.

I have been repeatedly impressed by the similarity between sympathetic ophthalmia and the ordinary type of iridocyclitis due to low grade infective processes, with the temptation to investigate a possible cause for inflammation in the first eye before enucleating; but felt that so much ground would be lost, thru these time consuming efforts, that the ultimate loss in efficiency of the second eye would not justify the attempt, and that the immediate situation was too urgent.

I wish to thank Dr. Harvey D. Lamb for his report and for the preparation of the slides.

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OBSERVATIONS MADE IN THE GOVERNMENT OPHTHALMIC HOSPITAL, MADRAS, INDIA.

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This hospital, with the Elliot School of Ophthalmology connected with it, constitutes an important center of ophthalmic training in India. There is a museum of specimens and clinical drawings. The hospital facilities and methods of operation and preparation of patients are described. The common diseases encountered, and the preferred treatments for them, are also given.

Major R. E. Wright, superintendent of the Government Ophthalmic Hospital at Madras, succeeded Lt. Col. H. Kirkpatrick whose predecessor was Lt. Col. R. H. Elliot. He resides at Egmore in the bungalow opposite the hospital which has been occupied by these three consecutively. It was formerly the property of Col. Elliot who planted a great variety of palms in the compound. Major Wright was formerly connected with the Pasteur Institute of Southern India and the King's Institute, Guindy, in the Bacteriological department. He was for a time Professor of Pathology at the Medical College, and is examiner in this subject to the University of Madras.

The Elliot School of Ophthalmology is situated in the Hospital grounds where among other things are a number of mounted specimens of pathologic eyes on exhibition, and a series of water color paintings of diseases of the eyes as seen in the East.

Altho Major Wright is the ophthalmic surgeon he necessarily must do the throat, nose and ear work for purposes of diagnosis in connection with eye disease, as there is no special throat, nose and ear department with this hospital.

There are three special operating days in the hospital. On Tuesdays and Thursdays, the aseptic globe operations, such as cataracts, iridectomies and trephinings, are done, and on Saturdays septic cases, lacrimal sacs, tumors, throat, nose and ear cases, etc., are operated upon. On Mondays, Wednesdays and Fridays the postoperative cases are seen on the table at the beginning of the day's work. Work starts at 8 o'clock in the morning. Subsequent to the operations, on Tuesdays, Thursdays and Saturdays the out-patient department is visited and new cases are seen. On alternate days, after the postoperative cases are examined, the in-patients are passed before him in file, first men and then women, each medical officer handling the cases belonging to his own ward, reading out the notes and entering the new directions.

Subsequently, cataract cases for discharge are examined and findings are recorded. After this the superintendent visits the refraction room and sees all cases kept for his consultation. Then fundus cases are examined in the

dark room and finally the out-patient department is visited. On Tuesdays, Thursdays and Saturdays the operations take up the greatest part of the morning so that he goes direct to the out-patient department on these days. After the out-patient department has been cared for, the administrative and office work is undertaken and subsequently the laboratory is visited and the pathologic material examined.

In the operating theater, while one operation is going on, the next patient is being noiselessly (the patient and attendants are barefooted) placed on the second table, so that the operator has only to clean up between cases and walk from one table to the other. There are about thirty cataract extractions a week, each case of which has been studied and classified before coming to the theater. In the afternoons private cases are seen, and lastly, there are many visitors to entertain. Major Wright kindly offered us the use of his Ford car and driver. The car was so very comfortable that we inquired why? His answer was that he had had the back seat lowered six inches, which made such a difference that he now calls it a Rolls-Ford.

The operating theater is under the care of the senior theater assistant Bophal, a Brahman, who has been in this service since the time of Col. Elliot. There are only six Anglo-Indian nurses; the remainder of the ward work being done by Indian male and female war attendants.

In preparation of the instruments for operation, the knives, scissors and needles are removed from pure lysol to alcohol and a second alcohol, and dried on an electric hot plate, so that each instrument is dry. There are two of all instruments, ready for each operation. The Madras bandage is placed under the head, ready to tie, before the operation is begun. In fractious cases the facial nerve is blocked. In certain other cases the akinesia of Rochat is practiced. The speculum is left in place during the whole operation, but the assistant superintendent manages it.

OPERATIVE TECHNIC.

During the two weeks of our stay there, there were many interesting operations: the Elliot trephine, the Kirkpatrick resection of the fornix, Major Wright's extirpation of the lacrinal sac, and the simple extracapsular extraction, with preliminary capsulotomy with Bowman's needle. The upper pole of the nucleus is displaced downward and made to present thru the tear in the capsule by the "dipping" movement of Kirkpatrick, at the upper scleral wound, with a small silver spatula. This preliminary capsulotomy with complete iridectomy and limbal section, known as the Madras operation, was first practiced in Madras in 1879 by Major Drake Brockman. Major Wright when about to extirpate a tear sac locates the anterior crest and the angular vein. The incision avoids the angular vein. His dissection is similar to Meller's and Wheeler's, with the exception that the internal canthal ligament is often left uncut.

The assistant trains the patient before operation. The patient has worn a trial pad over the eyes the night before. If this pad is not clean in the morning the operation is postponed and treatment instituted until the night pad is found clean. Morphin is given 15 minutes to 2 hours before operation (and also after operation). The lashes are cut from the outer half of upper lid; 4% cocain is instilled 3 times and one drop of adrenalin. The cul-de-sac is irrigated well with 1 to 3,000 perchlorid of mercury. The lids are pressed together at borders to empty glands and the debris wiped away with cotton applicator, and the conjunctiva finally wiped with a swab dipped in saturated aqueous solution of picric acid. After the speculum is placed, there is the second irrigation with normal saline from the copper teapot irrigator. To the forehead, brows and lids 2% tincture of picric acid is applied.

As aforesaid, preliminary capsulotomy is usually practiced. If the capsule is found resistant to the needle, the needle is withdrawn and the intra-

capsular operation is done. If there is loss of aqueous on removal of the needle, the anterior chamber is filled with normal saline solution before making the section. The assistant superintendent had wonderful control of the lids, lifting them away from the globe, thus making negative pressure and loss of vitreous improbable.

GLAUCOMA.

The treatment of glaucoma (of which there were many cases) was about as follows: morphin hypodermically, eserin instillations, purges (blue pill 4 grs. or pulv. jalap comp. and ½ oz. magnesium sulphat); magnesium sulphat irrigations of lower cul-de-sac; Bowman's needle paracentesis; rest in bed with leeches applied to temple. These were great fat leeches; three were usually applied. A piece of butter was laid on the temple and the leech's head was rubbed in this till it attached. The classic Elliot trephining is practiced when other methods fail. Late infections are found very rarely following a trephine.

A list of cases of potential sympathetic ophthalmia is kept. There were about 75 on this list.

OUT-PATIENTS.

The electric cautery is used so often that one is attached to a leg of each operating table. In iris prolapse the cautery is held near the iris, but not in contact with it, and thus vitreous is not lost. In small prolapse of iris the treatment is to apply a bandage to both eyes after instillation of 2% aqueous picric acid and eserin. The patient is kept quiet, bowels open.

The average daily number of out-patients is about 230 and these patients are seen every day. The following is a sample of one day's patients, demonstrated in the out-patient department:

Eclipse amblyopia in which there were macular changes.

Cyst of the iris cured by injecting pure phenol.

Hydatid cyst of right brow 1¼ inch in diameter removed.

Epithelioma in a boy 9 years old, associated with extensive freckling.

In a young girl about 15, rhinosporidium kinealyi of the sac. (Maj. Wright believes that the growths he has seen have been transmitted thru dust or water to conjunctiva, and not thru nares as was formerly supposed.)

Many catarrhal conjunctivitis cases (including Morax-Axenfeld's conjunctivitis).

Phlyctenular keratitis.

Gonorrheal conjunctivitis.

Keratomalacia.

Cases of corneal ulcer after strong alum treatment.

Panophthalmitis.

Aspergillus infection of lid.

Several cases of xerosis.

Several cases of marasmus.

Innumerable trachomas.

A large number of infections due to syphilis.

The xerosis and keratomalacia cases were given raw milk, and cod liver oil. The babies were annointed with cod liver oil. The temporal pallor of the optic nerve in nutritional atrophy is said to be capable of clearing up with the use of cod liver oil. In leprosy one may find temporal pallor of the optic nerve.

In anterior staphyloma, when the posterior segment is unaffected or still functioning, the best corneal segment is located and saved for vision. A trephining is done in this region, then with the electric cautery the rest of the cornea is cauterized radially. These radial lines cicatrize and flatten the protruding cornea.

When Saemisch section is done for *hypopyon ulcer,* the eye is not bandaged, but continuous irrigation with magnesium sulphat lotion is given. In one case, operated upon while I was present, there was not room in the anterior chamber for Graefe knife, so a Bowman's needle was used to pick open the line of incision. The pus was evacuated. The eye was bandaged for 2 hours, then bandage was removed and magnesium sulphat irrigations were given in lower cul-de-sac.

In treating *syphilis* mercurials are sometimes not borne well because the teeth are so poor. Sodium thiosulphat is used in these cases intrave

ously, should mercurialization develop and the gums become sore.

When giving intramuscular injections of mercury the needle is partially withdrawn to see that there is no blood, then if none, all the contents of the barrel are injected, the needle is left in position, and plunger removed and reinserted to push air in to prevent an abscess in skin and subcutaneous tissues from mercury.

Much is said about gonococcus infection in trachoma cases in Egypt and Austria. In India, trachoma and syphilis are found together in many cases. If treatment for trachoma fails to improve the condition, without making the Wasserman test, antisyphilitic treatment is instituted and the trachoma then yields to the combined treatment. Between courses of arsenic, mercury and bismuth, cod liver oil is given in both congenital and acquired syphilis.

A healed *cyst of the iris* was seen. The cyst was 3x5 mm. in size, situated between the anterior surface of the iris and the cornea. It was treated by means of inserting two fine bore needles carried on big, heavy syringes (made by the Dental Mfg. Co. of London). The contents were aspirated with one syringe, which was partly filled with normal saline, and with the other a drop of pure carbolic was injected. The cyst was then washed out with normal saline by alternately operating the two syringes. The cyst lining was apparently destroyed and the condition cured with the establishment of a round pupil. The operation was performed the year before, and the eye still remained quiet.

Treatment in potential *panophthalmitis* is a purge consisting of blue pill 5 to 8 grains; milk injection; subconjunctivally, cyanid of mercury; irrigation with magnesium sulphat 40 gr. to oz.; and intermittently dry heat.

Corneal ulcers that stain are penciled with iodin, and magnesium sulphat irrigation given.

When there is a nasty red eye (sclera) after cataract, magnesium sulphat irrigations and atropin are given. Magnesium sulphat is used in saturate solution.

The poorer Indian does not like to lose an eye, not for cosmetic reasons, but because he likes to hold onto his members, even tho unsightly. Major Wright makes paraffin globes by shaping a piece of hard paraffin with a scalpel. This is done with the patient sitting opposite, the mould being repeatedly tried in position. An Indian artist makes a drawing of the iris, and colors to match its mate. The colored paper is counter sunk in the corneal position and there embedded. A pupil of correct size is made. The paraffin substitute maintains the shape of the socket and a duplicate with correct size, shape, position of cornea and size of pupil is sent to London as a pattern for the glass eye, if the patient can afford one.

Enucleations are smoothly done. The external rectus muscle is cut long so that orientation is easy when the eye arrives at the museum. The horizontal conjunctival sutures are left untied. In tarsal resections the running conjunctival sutures are left untied.

After cataract operation, where the chamber remains empty, subconjunctival injections of cyanid of mercury are given.

In *detachment of retina,* a trephine over the detachment is made, a stitch placed and irrigation in conjunctival sac frequently done with magnesium sulphat, to encourage flow from within out.

Hook-worm disease prevails in India. The infection affects from 60 to 80% of the inhabitants. Eggs that are mixed with sand or earth develop most readily. The larvae become infective from 4 or 5 days old. Infection takes place either by the mouth directly, or the skin, usually between the toes. The careless disposition of feces permits pollution of the soil. The skin is irritated and this condition is called *ground itch.*

The hook-worm disease causes a widespread degeneration in a community Even tho the skin of the Indian is brown, there is a peculiar pallor to it in many children and adults. There is also underdevelopment, apathy and lack of energy and physical incapacity. When one sees the streets and ledges of the houses lined with

prostrate men and children, he must not think it is laziness from a full stomach and the warm humid atmosphere, but from the anemia due to anchylostoma, from hunger, malnutrition, syphilis and consanguinity.

Certain types of cataracts are found in infection with hook-worm. They are soft, white, almost filled with a milky fluid and have a small opalescent nucleus.

As cases go out, a full report of each is made.

Battle Creek Sanitarium.

THE PHOTOSCOPE.

JOSEPH I. PASCAL, B.S.

NEW YORK CITY.

The arrangement of fixation light and mirror here described is convenient for the shadow test and may be applied to other methods of examination. It keeps the patient's eye steady and undisturbed by movements of the observer or the light used in the test.

This is a simple device for making retinoscopy easier and more accurate. It consists essentially of two parts. 1. A small plane mirror, set in a metal frame, 1½ inches wide by 3½ inches long, mounted on a stand or bracket. The mirror is pivoted on the back so as to allow it to be rotated on a horizontal axis. 2. A small, round, 10 or 15-watt, frosted, blue-violet electric bulb, with a one inch round aperture. The mirror tilted upwards, is placed in front of the patient on a level with his eyes; and the light is placed directly above the patient's head. The arrangement is roughly sketched in the diagram attached.

By means of this instrument the patient's line of vision and the examiner's line of observation are made entirely independent of each other. As the patient looks into the mirror, he sees the reflected blue-violet light which serves as his fixation target. The examiner, working with his retinoscope behind the photoscopic mirror, can move backwards and forwards, from side to side and up or down, without changing or interfering with the patient's point of fixation.

The blue-violet fixation target has special significance. For this reason. When we say an eye is focused for infinity, it is really in focus only for the yellow component of the light. It is out of focus for every other color, on account of the chromatic aberration of the eye. In fact it is then about one diopter myopic, for the violet light. Accordingly, focusing the violet light at 40 inches places the eye in the same condition as when focusing a white target 20 feet away. By using the distances suggested in the diagram the violet fixation target is about 50 inches from the patient and is equivalent to an ordinary target about 25 feet away. This long distance tends to relax the accommodation.

Moreover, this target is restful to the patient's eyes, and does not stimulate the form sense, which is the main incentive to accommodative action. By using, if desired, a 5 or 6 diopter prism, base in, over one eye, the convergence of less than one meter-angle is relaxed. This combination tends to make the patient's fixation passive and definite, both for accommodation and convergence.

In addition, and what is of the greatest importance, the examiner can, at all times, get as near to the macular region with his retinoscope, as is practically desirable. He need not disturb the patient, or direct him to look in different places. By working above, below, or alongside the mirror, the examiner can refract the whole foveal region. Working within a radius of one inch from where the patient's visual axis cuts the mirror he can refract the eye to within about half a millimeter from the center of the fovea, and use that region which gives the clearest reflex.

Another great advantage is the fact that the examiner's line of observation

is practically perpendicular to the refractive surfaces of the eye and the neutralizing lenses used. This obviates the irregular and often confusing shadow movements, due to obliquity of observation. The instrument can be placed at any distance chosen, and works equally well for any observation distance. The writer, for good reasons, prefers an observation distance of about 26 inches, arm's length; the mirror and stand about 20 inches from the patient, and the blue-violet light about 20 inches above the patient. This places the reflected image of the photoscopic light about 50 inches from the patient. To bring the image into view, the photoscopic mirror is tilted up thru an angle of 20 to 25 degrees. Only the image of the light is visible, the patient cannot see any part of himself.

The instrument may also be used for making an ophthalmoscopic examination of the media of the eye. This is best done by placing the photoscopic mirror about 10 inches from the patient, and tilting it up thru an angle of 30 to 35 degrees, so that the blue-violet target is visible. By viewing the eye above, below and alongside the mirror the media can be explored without disturbing the patient's fixation.

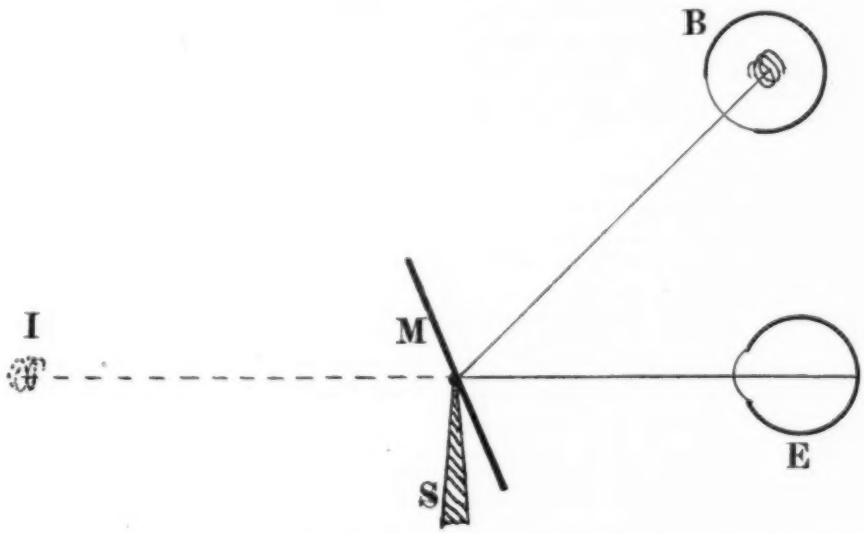

Fig. 1. Diagram of photoscope. B. Bulb reflected in mirror M.; so that it appears at I., behind the mirror, to the patient whose eye is placed at E. S. standard, supporting instrument.

To sum up, the chief advantages of the instrument for retinoscopy are that it permits passive, definite and unobstructed fixation on the part of the patient; direct, independent and variable observation on the part of the examiner. The importance of such fixation and observation for easy and accurate retinoscopy work is well known to all practitioners.

6 West 98th St.

NOTES, CASES, INSTRUMENTS

GANGRENE IN OPHTHALMOLOGY.

LAWRENCE POST, M.D., F.A.C.S.

ST. LOUIS, MO.

Gangrene of the eye and its adnexa is described in connection with the lids and with the lacrimal sac.

The cases of gangrene of the lids described, seem to have been necroses due to interference with blood supply to the part, with or without superimposed infection with putrefactive organisms, and not instances of the disease of gangrene as recent researches have tended to classify this entity. There has not been the characteristic foul odor and green color.

As early as 1906, Castellani[1] described two cases of lung gangrene with typical clinical and pathologic picture, in which he found in the tissue numerous spirochetes, similar to the organism associated with Vincent's angina, and also fusiform bacilli. The year previous, Rona[2] had noted these organisms in gingival pyorrhea in a case of lung gangrene and suggested the possible etiologic relationship.

Fishberg and Kline[3] have found spirilla in all of a considerable number of fatal cases of pulmonary gangrene which they have studied, and Kline[4] has succeeded in producing gangrene in a large percentage of cases in the devitalized legs of frogs by inoculation of the tissue with spirilla and fusiform bacilli from gangrenous tissue. The controls almost never showed characteristic gangrene, with the well known odor and color.

The washed sputum in pulmonary gangrene will almost constantly reveal the spirilla. They stain in smears with Fontana stain and in tissue with Levaditi. Kline and others believe that this spirochete is the sole cause of gangrene; that it acts on devitalized tissue to produce the disease and that the usual source of infection in pulmonary gangrene is from the buccal cavity, especially from the pus of pyorrhea alveolaris.

This spirochete, like the spirocheta pallida, yields readily to the arsenical preparations and cases of lung gangrene treated early with these drugs have responded well. This is a most important observation as lung gangrene has heretofore been almost invariably fatal.

If the hypothesis that gangrene depends on inoculation of devitalized tissue with an organism from the mouth is correct, it is natural that the lacrimal sac is more likely to be involved than the lids.

A case of gangrenous dacryocystitis in a baby four weeks old, was reported by Cange[5] in December, 1924. There was typical malodor and greenish color. The chief bacteriologic finding was "Very numerous spirilla, resembling in morphology the spirilla of Vincent." There were also numerous bacilli and cocci. The spirilla did not grow either anaerobically or aerobically.

The baby was desperately ill when first seen by Cange. The gangrenous area was swabbed with a solution of novarsenobenzol. The following day the lesion looked worse. An antigangrenous serum was used on this day. The next day the baby was much better. Two more doses were given on succeeding days. Five hours after the last, the baby suddenly collapsed and died.

Cange attributed the improvement to the serum and believed the anaerobic bacilli were the cause of the trouble. The serum usually employed in France for gangrene is made from perfringeus, B. oedematiens and various spirochetes, including S. cincenti.

In the light of the work quoted, it seems that a more careful distinction between necrosis and gangrene should be made and that in each case with odor and color characteristic of gangrene, a careful search for spirilla should be made and intravenous arsenical therapy instituted. The spirilla may not prove to be the causative organism in gangrene, but further

studies along these lines will determine this.

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LATE FUSION DEVELOPMENT IN TWO CASES OF STRABISMUS.

OTIS WOLFE, M.D.

MARSHALLTOWN, IOWA.

CASE 1. Miss B., age 20. Right eye crossed since infancy. Examination showed a case of noncomitant convergent strabismus. Perimeter test showed 35 to 45 degree deviations. Suitable glasses worn many years. Vision, right 10/200, corrected 18/200 under cycloplegia. Vision, left 18/30, corrected to 18/15 under cycloplegia. The first picture shows patient looking slightly to left, before operation.

A large tuck was made on the right external rectus with partial tenotomy of the right internal rectus. Orthoptic and stereoscopic exercises were instituted, with no tendency to fusion for the first four months. Since then she has developed stereoscopic fusion, and just after stereoscopic exercise she can fuse lights at distance and the eye is straight. The corrected, vision in the right eye is 18/70. A good cosmetic result was obtained, as shown in the second picture, altho the perimeter still shows 8 to 10 degrees deviation. She can do bar reading, but with difficulty.

CASE 2. Mr. K., age 46. History of right eye crossing, after "spasm," when he was a few months old. When ten years old, he was fitted with glasses that improved his vision, but not his squint. At first this case appeared to be a right convergent strabismus, but after several tests the left eye showed a tendency to fix. After repeated tests it was found that it could fix, but with difficulty, demonstrating that it was an alternating strabismus. V. R. 18/30, corrected 18/20 minus. V. L. 18/100, corrected 18/100. Perimeter showed 25 degree deviation of right eye and 20 degrees of left. Binocular fusion absent. Stereoscopic fusion absent.

Fig. 1. Convergent squint. Case I. Appearance before operation and after fusion training.

The left externus was tucked and orthoptic and stereoscopic exercises instituted, with little result for the first six months, except the cosmetic improvement. After that time, by aid of prisms, he began to obtain stereoscopic fusion of some of the Kroll cards. After nine months he has good stereoscopic fusion with Kroll and Wells cards, without additianal prisms. He fuses lights at a distance and can do bar reading. Positive Hering Test. Vision, corrected, R. 18/15. L. 18/20.

Fig. 2. Convergent squint, Case 2. Appearance before operation and after fusion training.

ITCHING OF EYELID DUE TO ALLERGIC REACTION.

F. W. Marlow, M.D.

SYRACUSE, N. Y.

Itching of the eyelids is not uncommonly observed in severe and long continued cases of eyestrain. It is also one of the most annoying and constant symptoms of vernal conjunctivitis, and of hay fever, and may also be observed in eczema of the skin of the lids.

I do not recall any experience of this symptom under any other condition except in the case now reported, in which it evidently depended upon the unusual susceptibility of the patient in regard to the substance causing it.

In this case it occurred as an intercurrent symptom in a patient who had recently been under treatment for an entirely different group of symptoms, and for a time the etiology was very obscure.

Mrs. C. C., age 34, came under observation on Feb. 22nd, 1926, on account of severe asthenopia, pain in eyes, photophobia, blurring in reading and also to some extent in the distance, vertigo, headache located in neck, ears; and more or less general, subjective sensations of heat rising, nausea but no vomiting. She had had four recent changes in glasses, each worse than the preceding one and was wearing a+1.25D cyl. ax 90° over each eye.

Examination showed R. V. $\frac{6}{12}$

with -0.25 S. $\bigcirc$ $+ 1.25$ cyl. $90° = \frac{6}{6}$

L. V. $\frac{6}{36}$ -1.00 S. $\bigcirc$ $+ 1.75$ cyl. $90° = \frac{6}{6}$

Esophoria 2°. Right Hyperphoria 1½° at 6 m.

P. P. C. 21 cm.

Abd. 6° — 7°.

R. Sursumduction 3° — 4°.
L. Sursumduction 1½° — 3°.

After scopolamin she accepted R. + 1.25 D. cyl. 90°. L. — 0.50 D. sph. ⌒ + 1.75 cyl. 90°.

Altho the difference between this finding and the glasses she was wearing might be sufficient to account for her discomfort, it seemed best, in view of the fact that she had a definite muscle imbalance, entirely ignored in the previous formula, to ascertain more positively the state of the muscle balance. An occlusion test was suggested and promptly accepted. The left eye was shut off with a ground glass, specific directions given to avoid any opportunity for binocular vision, and at the end of an occlusion period of seven (7) days she showed:

Exophoria 7°
R. Hyperphoria 1½° } at 6 m.
Exophoria 8°
R. Hyperphoria 1½° } at ⅓ m.
Abduction 10° — 14°.
R. Sursumduction 3° — 4°.
L. Sursumduction 1° — 1¾°.

Glasses prescribed on these findings:

R. — 0.25 S. ⌒ + 1.12 C. 90° ⌒ 2° prism base in.

L. — 0.75 S. ⌒ + 1.62 C. 87½° ⌒ 2¼° prism base in up 155°, gave complete relief from her symptoms.

On June 11th, 1926, I have the note, "Perfectly comfortable until three weeks ago, no headache. Severe itching of lids of both eyes, getting worse; use of eyes increases itching. Lids gum in the mornings, some cold in the head, and an unusual amount of sneezing." There was some congestion of both conjunctivae. A weak solution of sulphat of zinc and boric acid was prescribed.

On June 19th, she reported herself no better, the itching being as intense as ever, and as having attacks of sneezing as many as twenty-four times in succession, and so serious as to cause pain in the arms. On this date she told me that for the past four weeks, or a period covering the duration of her symptoms, she has been using orris root powder in her hair on account of undue moisture of her scalp. She was advised to discontinue it.

On July 26th on inquiry by telephone I learned that on returning home she had washed the powder from her hair and that two days later the symptoms had completely disappeared, and that she had remained quite comfortable since.

In reviewing mentally the case after a lapse of time, it is impossible not be struck with the general resemblance of the symptoms to those of hay fever, and anyone whose practice brought him in contact frequently with patients suffering from that disorder would doubtless have identified the symptom complex at once. I am reporting the case because its nature and etiology were at first obscure and in ophthalmologic practice certainly rare.

731 University Bldg.

CASES OF ASTEROID HYALITIS.

GEORGE H. MATHEWSON, B.A., M.D.
MONTREAL, CANADA.

This paper is a report of 3 new cases of snowball opacities of the vitreous. The author differs from Stark as regards the etiology.

This condition which was first described by Benson in 1894 seems to be rather rare. Cases have been reported by Holloway, Stark, and others and fortunately the chemical and histologic findings in one case have been set forth by Verhoeff.

I agree with Holloway that while this form of hyalitis is rare it is not so rare as would appear from the small number of reported cases. The ophthalmoscopic picture is quite distinctive. It differs from synchysis scintillans, very greatly. The asteroid bodies are spherical, or nearly so, while the bodies in synchysis scintillans are in the form of platelets. The former look like globules of yellowish-white fat while the latter resemble flat golden crystals.

The former are in the upper as well as the lower part of the vitreous, being scattered all thru it, while the latter are mostly in the lower part of the vitreous and, when disturbed by rapid movement of the eyeball, fall back to

the lower part of the vitreous like a shower of golden snowflakes.

Is it not possible that synchysis scintillans is a later stage of asteroid hyalitis?

Stark thinks tuberculosis to be the cause, but there seems to be no good reason for thinking that this disease was the cause in any of my cases.

CASE 1. March, 1922, Mrs. S. M. A., healthy female, 66 yrs. of age. Left eye only showed the anomaly, which was typical; both eyes were hyperopic and had equal vision, 9/9. The asteroids were about the size of a pinhead.

CASE 2. Feb. 8, 1926, M. L., male, 54 yrs. of age, myopic in both eyes, but had good vision with correction in both. The left eye only was affected. In it were seen very many bright bodies, not only in spherical form but also in ribbon like masses. This man had urinary calculi and when first seen had suppression of urine which, strange to say, was due to an urethral calculus which he passed a day later. He was discharged in good health apart from a heart lesion and is at work. The eye condition is unchanged.

CASE 3. March 29th, 1926, L. D., male, about 55 yrs. of age. Both eyes have very poor vision, a result of widespread retinochoroiditis, R. V. = fingers at 18 ft. L. V. = fingers at 2 ft. Wassermann doubtful. Vision bad for 2 yrs. only.

Left eye shows many asteroids.

All three cases were discovered by chance, in routine examination of the eyes, as there were no subjective symptoms.

A good bibliography is given in Stark's article A. J. O. 1924, p. 770.

202 New Birks Bldg.

SOCIETY PROCEEDINGS

CHICAGO OPHTHALMOLOGICAL SOCIETY.

May 17, 1926.

EDWIN J. GARDINER, M.D., PRESIDENT.

Ocular Conditions in Diabetes.

DR. HARRY GRADLE said that cataract was by far the most common. He gave tables showing the percentage of lens opacities in various series of diabetics, with comparison with percentage of lens opacities in nondiabetics. Retinitis is the next most common. He gave tables showing percentage of retinitis in various series of diabetics, with classification and discussion of diabetic retinitis.

Discussion. DR. WILLIAM H. WILDER asked whether in those cases in which retinal hemorrhage had occurred there were ophthalmoscopic evidences of arteriosclerosis. It was true that in retinitis occurring in diabetes the hemorrhages sometimes seemed to have a very distinctive appearance, particularly in regard to their situation and the size of the patches, but when it was remembered that hemorrhages may occur in the retina in a more or less haphazard arrangement, it caused one to doubt whether there was justification for believing that any arrangement of patches of hemorrhages or lesions associated with them was distinctive of diabetes. Rarely, if ever, had he seen a case of retinitis occurring in diabetes in which careful ophthalmoscopic study would not reveal evidences of arterial changes.

Similar observations were made in a large number of cases in the Mayo Clinic, and such a condition of sclerosis of the retinal vessels might be sufficient to account for the hemorrhages as well as the other lesions seen in so-called diabetic retinitis.

DR. HARRY GRADLE said that Wagener and Wilder had found forty-four cases of retinal disease among 300 diabetics, from which they drew the following conclusions:

1. Retinitis did not occur in uncomplicated cases of diabetes, even of the severe type. (It was not present in eighty consecutive cases).

2. Cases of diabetes with retinitis were always complicated by vascular or renal disease and the diabetes was apt to be mild and chronic.

3. The cause of the retinitis in diabetes seemed to lie in the accompanying vascular changes.

Foster Moore was practically the only authority today who maintained that there was such an entity as diabetic retinitis. According to Ottfried Müller, Weiss, Zeller, and others, in diabetes, hypertonicity and nephritis, very marked changes were found on capillary microscopy, and Vollhard stated that he had never seen a case of diabetic retinitis in which there were not the other changes seen on capillary microscopy. In all cases of retinitis in diabetics he himself had seen, there had been more or less retinal sclerosis, and his impression was that the retinitis that occurred in diabetes was due either to vascular hypertension or nephritis in its broadest sense.

Mechanism of Accommodation.

Dr. William H. Luedde, St. Louis, by invitation read a paper on this subject. See p. 15.

Discussion. Dr. William H. Wilder thought that everyone present had been stimulated by hearing the paper on this most interesting subject, and felt that he voiced the opinion of the Society in complimenting Dr. Luedde on his very scholarly presentation and also on the elaborate work he had evidently done in arriving at his conclusions. Of course, such a subject must be approached with open minds and not with any preconceived prejudice. In scientific matters we should not align ourselves, as in theology, as orthodox or heterodox, and certainly should not feel definitely committed to any hypothesis. It was difficult to imagine that when the eye was at rest it was still in a state of sustained tension. That was a paradox that had always seemed to him rather difficult to explain, and yet the general teaching was to that effect, and that owing to the inherent elasticity of the lens there was a distinct tendency to sphericity of the lens on relaxation of this tension. As had been observed by Young, by Hensen and Voelckers, by Helmholtz and others, it undoubtedly did change its surface in the act of accommodation, but it was still a question whether that change in surface was, as held by the Helmholtz hypothesis, the curve of a sphere or the curve of a parabola or an hyperbola. According to Tscherning's explanation, the peripheral portions of the lens were flattened, with the result that there was formed something like an anterior lenticonus, by which the increased refractive power of the lens was brought about. The solution of the whole problem would seem to rest upon the determination of the kind of curvature of the anterior surface of the lens during the act of accommodation. The measurements of the antero-posterior diameter and the curvatures of the dead lens were not satisfying, nor did they furnish convincing proof of its elasticity. There might be enough error to account for all the change that was evident in the measurements by different authorities, yet such measurements were adduced as a strong argument in favor of Helmholtz' hypothesis. It was true that evidence of elasticity in the lens was sometimes observed clinically, or, more accurately, a tendency toward assuming a spherical form. This was observed by anyone who studied cases of detachment or dislocation of the lens into the vitreous or anterior chamber, especially in congenitally displaced lenses. Holmes Spicer described years ago a case of congenital displacement of the lens in which the increased curvature caused a myopia of 40 diopters or more. Such a case, however, proved nothing more than that the lens had preserved much of its embryonic form. With active accommodation there occurred contraction of the pupil, by reason of which the spheric aberration of the lens was lessened. If the iris were rigid enough, one could conceive how the forcing of the contents of the eyeball and the plastic lens against it might result in a lenticonus at the pupil, but, of course, such a condition of rigidity of the iris did not obtain. The theory of Tscherning in regard to accommodation might help to explain some of the unusual cases sometimes observed, in which accommodation was retained after extraction of crystalline lenses. A

case he had studied twenty-five years ago might be of interest in this connection: A boy about twelve years old, celebrating the Fourth of July, received the charge of a toy cannon in the face. The eyes were thickly sprinkled with unburnt black powder grains, many of which penetrated the cornea and could be seen in the iris and lens. A violent inflammation ensued and it was thought that the eyes were lost. However, the severe iridocyclitis rather promptly subsided after the use of subconjunctival injections of solution of bichlorid of mercury, leaving traumatic cataracts, which were subsequently removed by discission and good vision followed. Some years later, the patient returned to have his glasses changed, and examination showed clear pupils, about 2.5 to 3 mm. in diameter, slightly irregular, but quite rigid. Distance vision with correcting lenses was good, and he said it was unnecessary to give him stronger glasses for reading as he could read easily with his distance glasses. Upon testing it was found that he could read the finest Jaeger print with his distance lenses, and in making the attempt his pupil did not seem to change in size. He did all near work readily with his distance glasses. The accommodation could not be explained by saying that he was looking thru a pinpoint pupil, for it was of fair size, at least 2.5 mm. in diameter. This patient was presented before this Society at that time, but afterwards disappeared from observation and had not been seen since. This would have been an interesting case for study with the slitlamp, which was not in use at that time. Apparently the only explanation was, that in some way the ciliary muscle in contracting pressed a small bead of vitreous into the rigid pupil. This bead of vitreous may have been covered by a thin film so that it did not prolapse into the anterior chamber, but formed a kind of lens in the pupil, thus bringing about accommodation. Such an occurrence would seem to speak for a compression of the vitreous body by the muscular apparatus that was concerned in the act of accommodation.

It was generally admitted by Helmholtz and Hess that in the act of accommodation the anterior chamber was deeper at the periphery. Both Tscherning and Helmholtz thought that was an argument in support of their respective hypotheses. If these circular fibers were active, that would explain why the anterior chamber was deeper.

Dr. Frederick A. Davis said that in the course of studies he had made in congenital eye defects in rabbits, he had repeatedly observed changes in the shape of the lens. In the paper he had recently presented before this Society, it would be recalled that all the rabbits' eyes in which there was coloboma of the iris, choroid and probably zonula, showed more or less spherical lenses. This spherical shape was present in the adult eye and in the eye of the newborn rabbits, as well as in the eyes of the embryos in which there was coloboma. In his papers he had assumed that the relaxation of the zonula in the colobomatous area allowed the lens thru its own elasticity to expand and become spherical. This was very striking in most of the specimens, particularly in the embryonic eye at twenty-one days. The fibers of the zonula must exert some tension on the lens whereby it assumed an elliptic shape. In other words, the growing lens fibers were bent upon themselves, due to the restraining effect of the zonula. He had also noticed that the lenses were drawn upward and slightly backward, as Dr. Luedde described in some of his specimens, or in other words, they were drawn away from the region of the coloboma. This he assumed was brought about by the tension of the intact portion of the zonula.

Dr. Arno Luckhardt said that this was an extraordinarily difficult theory to propound. The experiments quoted on the iris contraction having some effect on the lens might hold for the particular animal on which they were done; but a man without an iris, it was well known, could accommodate as well and as fully as one who had an iris. The difference of opinion was, essentially, concerning the point of

greatest fixation of the meridional fibers of the ciliary muscle—whether at the choroid or at the corneosclerotic junction. If the choroid was pulled forward, the suspensory ligament must relax, and he could not understand how Dr. Luedde would interpret the findings of Hess, who maintained that after each instillation of eserin, which induced profound accommodation, the lens became quite wabbly and moved about by gravity, depending on the position of the head. This, if a fact, was interesting; there was a statement in the literature by some gentleman with a Russian name, that there was a definite hypertrophy of the fibers of the ciliary muscle in cases of hypermetropia which had been left uncorrected. Helmholtz ascribed no particular function to the circular fibers. And just these fibers were reputed to be hypertrophic in advanced and uncorrected hypermetropia.

Dr. Michael Goldenburg asked Dr. Luedde whether it has ever been demonstrated that the choroid had the ability to stretch or move forward. Also, if it was not possible that the dilatation of the large vessels in the choroid might push the vitreous forward.

Dr. William H. Luedde closing, wished to thank the members of the Society for their patience in following him thru the consideration of the various phases of this problem, and for the generous discussion. He was fully in accord with Dr. Wilder's admonition to rid ourselves of preconceived prejudice. We must record known facts, search for additional information, and join them all by the most obvious explanation, whether it accorded with Helmholtz, Tscherning, Hess, von Pflugk, Schoen, etc., or with none of them. One plausible error in current opinion regarding accommodation was that elasticity of the lens had been proved, whereas it had only been assumed. A critical study of the literature showed on what slender shreds of evidence this assumption had been based. The natural tendency of fluids or semifluid masses to assume a spheric form under the familiar laws of surface tension of physics had been ignored. That was a reaction in no way related to true elasticity. Competent observations of the fresh vitreous and of juvenile lenses showed that the vitreous was more truly elastic than the soft mucoid lens substance, yet it was in these young persons that accommodation was most active. It was rather gross carelessness to call the lens an elastic body.

Dr. Wilder's experience revealing active accommodation in an aphakic eye was of much interest. Both the clinical evidence and Dr. Wilder's explanation were in full accord with a paper presented by Dr. F. Park Lewis at the meeting of the American Academy of Ophthalmology and Oto-Laryngology in 1920.

While there were great variations in individual measurements of the lens surface, Young's experiments with his optometer, added to Tscherning's measurements and Grossman's observations in the famous case of aniridia, all went to show that during accommodation the convexity of the central area of the human lens was increased much more than the periphery. Where the pupil was sufficiently large, accurate measurements showed that refraction was increased much more at the center than at the periphery of the lens during accommodation. If the whole lens approached the form of a sphere as assumed by Helmholtz, the effect upon refraction would be just the opposite. Spherical aberration would increase refraction at the periphery more than at the center.

Pflugk's frozen sections of pigeons' and monkeys' eyes demonstrated this actual change in the form of both anterior and posterior surfaces of the lens (that is, polar bulging and relative peripheral flattening). Dr. Luckhardt truly said that the experiment with one animal proved nothing for another species, but the general plan of the mechanism of accommodation had been traced thruout the series of vertebrates to show that nowhere else did nature resort to relaxation of the zonula to produce the changes in the form and position of the crystalline lens incident to accommodation, leaving the zonula under tension at all

other times. To impress this contrast on his students he had put the old notion into rhyme, attaching it to the familiar lines:

"Now the day is over
Night is drawing nigh
Shadows of the evening
Flit across the sky."

Eyes of birds and reptiles
Now may go to rest
But boys' and girls' poor zonules
Must pull their level best.

As pointed out in the paper, it was Hess' positive observations of some relaxation of the zonula, as he said at a "certain angle" in strong accommodative efforts, that proved to be the greatest barrier to a possible successful harmonization of the scheme of accommodation in mammals with the general plan of all other orders of vertebrates. This relaxation was explained when the structure and relations of the zonular fibers was studied. It was an important fact overlooked by others as well as v. Helmholtz that the zonula was not in any sense a membrane but as Berger put it, a system of "petite cordellettes." Hence, some fibers might be relaxed while others were taut. Indeed this would seem to be the very purpose of their arrangement. It was easy to distinguish the accommodative bundles from the supporting fibers histologically. It was the latter which were relaxed at a certain stage, and thus permitted the lens to sink or tremble with jerking movements of the eyeball. The accommodative fibers lay next to the vitreous and remained under tension thruout the act of accommodation—that is, as soon and as long as the traction of the ciliary muscle upon the choroid compressed the vitreous. There was no evidence that these accommodative bundles were relaxed at any stage of the process. In reference to Dr. Luckhardt's mention of the apparent circular bundles in the hypertrophic ciliary muscles of hyperopic eyes, Schoen's explanation that these circular fibers acted like a purse string compressing the anterior segment of the vitreous by direct pressures, thus supporting the general compression by the choroid and concentrating its effect upon the posterior lens surface, might be suggested. The iris was not needed to produce the polar bulging of the lens. Compression of its periphery by the vitreous against the taut accommodative fibers would necessarily cause polar bulging.

In answer to Dr. Goldenburg, first, Hensen and Voelckers were able to measure the advance of the choroid in dog's eyes to the extent of 3/4 mm.; second, it seemed unlikely that dilatation of the choroidal vessels played any part in the compression of the vitreous. Finally, there was no evidence of a change in the refraction of the cornea during accommodation in hyperopic eyes. With reference to Dr. Davis' observation of greater sphericity of the lens corresponding to the location of the coloboma in rabbits' eyes, it seemed to be a fact that rabbits have very little if any power of accommodation. If there was a defect of the zonular fibers corresponding to the coloboma, the soft lens substance might bulge there, approaching a spherical form in simple obedience to the laws of surface tension.

C. Loeb,
Cor. Secretary.

MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA.

Section on Ophthalmology and Oto-Laryngology.

May 21, 1926.

Dr. W. T. Davis, Chairman.

Method and Principles of Muscle Recession in the Correction of Squint.

Dr. P. Chalmers Jamieson said that in 1922 he published his paper on recession which had been read before the American Ophthalmological Society in this city.

The paper was a result of the belief that a muscle could and should be receded with the same exactitude as an advancement was done.

The desire of operators to make tenotomy a safe and reliable operation is exhibited in the number of tenotomy procedures which have been devised.

Restricted tenotomy, partial tenotomy, cross-cut tenotomy, buttonhole tenotomy, muscle stretching and guarded tenotomy, are all evidences of the desire to ensure safety of convergence by prevention of retraction.

Advancements for the most part have been operations of precision. The advancement or resection or the combination of the two are measured and graded, the muscle end secured by sutures to the sclera anterior to the stump or to the stump and held until fixation to the globe has taken place.

Tenotomy had never been an operation of precision. The muscle and capsule field were seldom satisfactorily exposed; gradation and accurate measure as to the effect were imperfectly made; and scleral fixation back of the capsule was not practiced.

He said that he found in his work at the Brooklyn Eye and Ear Hospital if the principles of advancement were applied to tenotomy as they are now practiced in the operation of recession, the whole complexion of tenotomy is changed. True recession with complete exposure of the field permitting study of existing muscle and capsular conditions, accurate gradation of amount of recession and direct scleral fixation in the region of the equator by scleral sutures, change and almost revolutionize the operation of simple tenotomy both as to the amount of the effect obtained and the protection of convergence and excursion after it is obtained.

The recession operation practiced in this way by one scrupulously careful as to the technic, takes tenotomy out of the shadow of uncertainty and places it upon a new plane which is almost revolutionary.

This has been made possible by the demonstration of the safety and practicability of the scleral suture in the region of the equator.

The only reference to scleral suturing which he had been able to find was that of Dr. Curdy of Kansas who sutured to the episclera after tenotomy in conjunction with his advancement.

The principles of recession can be discussed under four headings.

1. Exposure of the capsule and muscle field.
2. Retroplantation of the muscle and capsular flap in bulk.
3. Scleral suturing and the technic of the nonperforating suture.
4. Gradation and determination of amount of recession.

Dr. Jamieson further said that if one were to suggest a very general and simple rule to follow for internal deviation, it would be 5 mm. of recession for the higher deviation, 2½ to 3 mm. for the lesser deviation. One of the striking and gratifying phenomena of recession in bulk with scleral fixation is the ability of the muscle to adjust to convergence required.

But while we recognize this adjustive ability, a careful computation, taking into consideration all the factors at our command is advisable. Taking the equator as the possible limit to which a muscle should be receded, the average distance between the insertion of the internal rectus and the equator is not probably more than 5 and at most 6 mm., the measurements depending on the diameter of the cornea and the distance between the insertion of the muscle and the limbus. These, therefore, should be measured. A cornea measuring more than 11 mm. in the horizontal would indicate a large eyeball, therefore, in our computation in mm. more than 5 mm. might be allowed.

A double recession of 4 or 5 mm. will correct deviation of 40° or 45° in a high percentage of cases of internal squint.

A single recession of 5 mm. will correct most cases of 20°. These computations do not correspond to recession of the external recti.

Dr. Jamieson gave a brief description of the operation he devised.

He further said that recession and advancement can be practiced at the same time. The procedure, however, which the writer adopts and advocates is to make recession, either single or double, the primary operation, leaving the advancement until some subsequent period if necessary. This for two reasons. 1st. Because the yield from re-

cession is so large that supplementary advancement in most cases is not necessary. 2nd. Recession with scleral fixation definitely placed, healed and sealed to the globe, is the most reliable guarded tenotomy possible.

He said that he was sure that the recession operation had come to stay and that if one did not employ it he was depriving himself of a valuable procedure for the correction of squint and that there was no single operation which would yield as large, as staple or as uniform a correction in strabismus as recession in bulk, with scleral fixation by scleral suturing.

Discussion. Dr. J. N. Greear, Jr., said that he believed this was a real step forward in the surgical treatment of squint. He said he expected to give this method a thoro trial. After having heard Dr. Jamieson's paper, and having assisted him with this operation, he was thoroly convinced that this procedure had come to stay.

Dr. John W. Burke said he thought we were particularly fortunate in having Dr. Jamieson demonstrate the operation which he had devised. It seems most reasonable—has been the first attempt as far as he knows to rationally fix a tenotomized muscle back to the globe and he intends to perform this operation as soon as he can get some suitable cases.

Dr. R. S. Pendexter said he thought an important point in favor of the operation was in placing the suture away from the ciliary angle. His only objection was the possible difficulty of the scleral suturing.

J. N. Greear, Jr.,
Secretary.

THE MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

October 12, 1926.

Dr. W. Likely Simpson, Presiding.

Osteoma of Orbit.

Dr. P. M. Lewis presented M. C., colored, aged 48, who was shown before the society Aug. 10, 1926, just prior to operation.

On Aug. 12, 1926, operation was performed under general anesthesia. As the growth seemed to involve mostly the medial half of the orbital roof, an incision was made similar to that of Killian's Frontal Sinus operation. On stripping back the periosteum a large bony mass was found involving the entire floor of the frontal sinus and extending back to the apex of the orbit. The entire anterior wall and floor of the frontal sinus was removed and the growth chiseled out as far back as the orbital apex. Dura was exposed for an area 4x2.5 cm. The periosteum was closed with catgut and the skin wound closed with Michel clips except at the medial angle, where a small rubber tube was inserted for drainage.

The growth was not a typical osteoma. It was more of a wide-spread exostosis. There was no line of demarcation between it and the orbital roof. It was not quite as hard as osteomas are.

The wound healed nicely and the deformity produced was not great. Convalescence was retarded by an attack of pleurisy. The patient was entirely relieved of the constant severe pain which she was suffering prior to operation. Exophthalmos, however, was still present. The cause of this was obscure. The bony growth was entirely removed and the globe could be pushed well back into the orbit immediately after operation.

Discussion. Dr. M. B. Seligstein had seen the case before operation, and said that there was now definite improvement.

Dr. Robin Harris had two cases of tumor of frontal sinuses recently. Each sprang from the septum between the sinuses.

Dr. W. L. Simpson had seen a bony tumor of frontal sinus loose in the sinus.

Dr. Lewis (closing) said that the tumor did not spring from the periosteum. It appeared to be an exostosis extending backward along the floor of the sinus farther than was safe to follow.

Bilateral Aniridia.

Dr. M. B. Seligstein presented M. A., aged 4, who had the left eye turned

in since shortly after birth, getting worse daily.

Both eyes showed complete aniridia. Convergent strabismus left eye. Right eye showed posterior polar cataract.

Discussion. Dr. A. C. Lewis presented a case of this kind six years ago to the Memphis and Shelby County Medical Society.

Dr. E. C. Ellett said that these cases sometimes develop glaucoma.

Sebaceous Cyst of the Orbit.

Dr. E. C. Ellett reported the case of J. W., aged 12, who had a bulging of the left eye and orbit, with convergent squint of the left eye since one and a half years old. Vision 3/200. The right eye was normal. The left showed a smooth, firm tumor in the upper outer quadrant of the orbit, not reducible, not pulsating and not fluctuating.

Eye converged and proptosed. The nerve and retina looked slightly edematous. Under ether the tumor was exposed by a canthotomy and an incision thru the conjunctiva, and proved to be a large sebaceous cyst. (Specimen shown.) It lay outside the muscles, and had no attachment to the ball or periosteum. The wound was closed with drainage. Drain removed in three days. A month later the eye was still turned in, but the main deformity seemed to be the result of absorption of the orbital fat. Vision 15/200. Eyegrounds were unchanged.

Discussion. Dr. P. M. Lewis asked what caused the squint.

Dr. E. C. Ellett said that it was an atypical concomitant squint.

Ocular Paralysis.

Dr. E. C. Ellett reported the case of James Y., aged 7, who had some peculiarity of his vision which he attributed to a fall from a swing September, 1922. He was bruised about the left eye but not unconscious or badly hurt.

He had been examined several times and glasses fitted, without any effect on his eye trouble. There was some blurring on use, but the main trouble was that he saw double when he looked either up or down, and down to the right, but not down to the left, vision 20/20 and Jaeger 1 in each eye. Eyegrounds normal. With a red glass before one eye there was a diplopia, the image of the right eye being up and to the left. This was best shown on the chart recording the diplopia tests on the tangent screen.

The manifest defect was limitation of motion of the left eye, both up and down as shown in the photograph. There was a question as to whether or not the condition was congenital. If not, the injury may have been the cause.

Convergent Squint.

Dr. E. C. Ellett reported the case of A. S., seen in 1910, aged 3, who had a convergence of the right eye for two years, apparently excited by whooping cough. She was a twin, the sister having normal eyes. Refraction under atropin, measured by retinoscopy, was +3.+1.Ax. 90. Glasses and a blinder on the left eye were prescribed; but the squint was unchanged. In 1916 vision was tested, the child not having been seen during the intervening six years. O. D. 8/200, O. S. 20/20. Under atropin the left eye showed +1.+1.Ax. 75°, and the right eye about the same. Vision in the right eye had been 20/200 for the last ten years. There was a convergence of 15 degrees measured with the Priestley Smith tape, and there was no binocular vision. The following measurements of the refraction in the left eye had been made.

1916 O. S. +1+1 Ax. 90°. Vision equaled 20/20 under atropin.

1919 O. S. —.50+1 Ax. 90°. Vision equaled 20/20 under homatropin.

1922 O. S. —.50+ 1 Ax. 175°. Vision equaled 20/20 under homatropin.

1926 O. S. —.75—1.25 Ax. 175°. Vision equaled 20/20, without cycloplegic. These changes in refraction had not been accompanied by any change in the squint. Operation advised repeatedly since 1916 and declined.

Discussion. Dr. A. C. Lewis asked Dr. Ellett to explain the changes in the refraction.

Dr. Ellett said that the changes in refraction were real as the tests were all made by one person and under similar conditions. The myopia could be explained by stretching.

M. B. Seligstein,
Secretary.

BROOKLYN OPHTHALMOLOGICAL SOCIETY.

October 21, 1926.

Dr. James H. Andrew, Presiding.

Diabetic Iritis.

Dr. W. B. Agan reported a case of diabetic iritis. The unusual feature of this case was the rather sudden appearance of a mass in the anterior chamber. It was lens shaped, amber in color and occupied a position temporally and below. At first it appeared as tho the lens had been dislocated into the anterior chamber but the mass was too small in size. It was finally decided that it was either an organized exudate or a ring sarcoma of the iris. Because of its color and its apparent origin from the angle of the iris, the latter was thought to be more likely, altho the rapidity with which it came on was against this diagnosis. Soon after its appearance, the tension became increased and the eye more painful. Enucleation was performed under gas oxygen anesthesia. The postoperative hemorrhage was not controlled until the third day. Microscopic examination of the specimen showed the mass to be a hypopyon.

European Methods.

Dr. Ralph I. Lloyd spoke of his trip abroad. In Vienna local anesthesia is used a great deal, enucleations for the most part being performed this way. The lid injections of novocain are being used in cataract extractions. Many operators are omitting the iridectomy in cataract operations and are using forceps to bite a piece of the anterior capsule in its central part. The claim is made that discissions are seldom necessary. Trephining is being abandoned because of secondary infections and fistulization. In cases of low tension—where it is above ten, cyanid of mercury drops are used; if below ten, do away with the fistula, as the maintenance of low tension causes iridocyclitis. The fistula is localized with fluorescein. The operations which are being performed for glaucoma are: (1) iridencleisis, (2) cyclodialysis—in which a piece of iris as large as one half of the corneal circumference is freed.

Wm. F. C. Steinbugler,
Secretary.

OMAHA AND COUNCIL BLUFFS EYE, EAR, NOSE AND THROAT SOCIETY.

October 20, 1926.

Dr. A. R. Knode, Presiding.

Retinitis Proliferans.

Dr. A. L. Lindquist presented a patient who was seen one year before when the fundus showed only a few striae in the lower part of the retina. Almost the entire upper half of the visual field was absent, however. Three weeks before, he appeared again and showed the present condition. White bands evidently of fresh connective tissue were seen in the vitreous connected with the retina. No actual exudate or hemorrhage had been seen at any time.

Penetrating Injury.

Dr. F. W. Dean showed roentgen ray pictures. The steel was evidently imbedded in the sclera or in the posterior vitreous. There was no reaction to the giant magnet so it was decided that the foreign body had probably gone thru the eye and remained imbedded in the sclera.

Discussion. Dr. Harold Gifford mentioned a boy who had received an injury with steel in whom he could see the steel with the ophthalmoscope imbedded in the retina. The steel had been retained for two years, the eye showing no reaction and vision remained 20/20.

Dr. J. M. Banister advised leaving the steel alone.

Corneal Injury.

Dr. J. T. Maxwell reported a patient with a piece of coal imbedded in the cornea. It was impossible to remove all of the coal by curettage. In attempting to do so, the anterior chamber was opened. The escape of aqueous was followed by a subsidence of the inflammatory symptoms but some coal remained in the cornea.

Discussion. Dr. Banister advised leaving this as it was probable that the coal would cause no further damage to the cornea.

Dacryocystitis.

Dr. F. W. Dean showed slides demonstrating a procedure for probing the lacrimal sac in cases of dacryocystitis thru an opening in the skin and using a large piece of silver wire to keep the opening patent.

Sanford Gifford,
Secretary.

ROYAL SOCIETY OF MEDICINE, LONDON.

Section of Ophthalmology.

October 8, 1926.

Mr. Ernest Clarke, C.V.O., F.R.C.S., President.

Detachment of Retina.

Mr. M. S. Mayou sent a case which Mr. Cunningham demonstrated, of massive detachment of the retina. Where there had previously been hemorrhages, there were now pigmented areas. The view of Mr. Mayou was that it was a massive exudate and the case an instance of Coats' disease. There was no history of any injury to be obtained. The condition of the boy was discovered at a school clinic in 1923, when the vision of that eye was 6/18. Since that date the sight of the eye had been gradually getting worse. The detachment was first seen only a month ago.

Shrinking of the Conjunctiva.

A further case of Mr. Mayou's was one of essential shrinking of the conjunctiva. It was thought it might have been caused by pemphigus, but of three expert dermatologists called, two did not consider the patient had had pemphigus.

Electric Retinitis.

Dr. Hugh Thompson brought this case, a condition probably identical, he thought, with eclipse blindness. A member had suggested to him that the stippling in each macula might not have been due to the brilliant flash, but might have been preexistent. Dr. Thompson, however, considered that the trouble was caused by the electric flash, especially as a fellow workman engaged on the same piece of work had temporary blindness following the discharge. In the present patient there had been no detectable improvement in three months. Apparently, there was no central scotoma.

Tumor of Lid.

Mr. Montague Hine exhibited a case of neurofibromatosis of the right upper lid, for which he asked the advice of members as to the best treatment. The boy came to the hospital last March as the eye was hurting him and he found the discharge from it difficult to check. On the lower lid were ulcerations, where the upper lid overlapped it. The right eye was at the present nearly blind, the patient having in it mere perception of hand movements. There was nothing wrong with the fellow eye. Another patch of neurofibromatosis was found in the temporal region of the patient, and he also had a small lump on the back of the head. His idea had been to remove the eyeball, with upper and lower lids, providing for the patient epitheliated sockets, as had been frequently done for war injuries. He thought it possible, however, that some member might be able to recommend to him a less drastic procedure.

Discussion. Mr. Treacher Collins referred to the treatment which Mr. Simeon Snell carried out in cases of the kind. In some of them, that gentleman removed a large piece of the eyelid, with a great cosmetic improvement. One patient of Mr. Snell's had buphthalmos, and the eye was sent to the speaker, Mr. Collins, for pathologic examination. At that examination the ciliary nerves were found to be involved, as well as the nerves of the eyelid. The choroid, also, was remarkably thickened and when cutting sections of the choroid he found bodies which looked like enlarged nerve end organs.

Mr. Frank Juler spoke of a case of the kind which he brought before the Section six years ago. In that patient both lids were affected, the lid of the worse eye protruding markedly.

The eye was at first thought to be buphthalmic, but the final view was that there was nothing more than high myopia, and, so, the question of excision was left. Large wedge shaped excisions were made. In this case also the condition extended to the temporal region, where most of the growth was removed to the material improvement in the patient's appearance.

Interstitial Keratitis.

Mr. Humphry Neame showed a case with marked radial corneal deep striation. Three-fourths of the corneal area was taken up by this. Wassermann was positive and he thought the appearances were due to congenital syphilis, but no syphilitic stigma was evident.

Mr. Treacher Collins considered that these were rucks in Descemet's membrane.

The President spoke of one case, regarded as syphilitic, which turned out to be tubercular.

Evulsion of Optic Nerve.

Mr. J. F. Cunningham showed a patient who had a mass obscuring the disc. In 1920 the boy attended hospital as an ordinary refraction case. The left eye was defective and the father said he was anxious about the case as another son had lost an eye in consequence of glioma of the retina, and an uncle had had the same disease. This present boy, he reported, had been struck in the eye by the handle of a scythe nine months before Mr. Cunningham saw him. It seemed to come into the category of evulsion of the optic nerve.

Ectopia Lentis.

Mr. David Wilson showed a man who, during an illness associated with violent coughing, dislocated his lens into the anterior chamber. The patient's doctor had been treating him for conjunctivitis. When seen a fortnight after this accident, the man had glaucoma. The eye, being blind, was removed, and a cataractous lens was found lying in the anterior chamber.

Tay's Choroiditis.

Dr. Rayner Batten exhibited and demonstrated on the screen a number of illustrations of this disease.

Advance in Ophthalmology.

The remainder of the evening was occupied by the President reading his address, which passed in review the advances which could be credited to the specialty in the course of the last half century, 45 years of which he had himself been practicing.

In 1881, when attending the clinic of Donders, in Utrecht, he saw Snellen demonstrate his scheme for the detection of malingerers by showing red and green letters thru red and green glasses. It was difficult for some of the younger men to realize that it was as recently as 1884 that Koller of Vienna, introduced cocain to the profession. This substance and its allies were in such universal demand that it was well to have always in mind their possible misuse. Pain was nature's great warning, and it was not sound to seek to allay pain without trying to ascertain its cause and treating that cause.

Perhaps the greatest advance in the specialty in the time under review was in the treatment of errors of refraction and muscle balance. In earlier days the refractionist's armamentarium was very limited and eyestrain was known as asthenopia. The only symptom laid at its door was headache. Mr. Clarke's book on eye strain, written in 1881, owed its inspiration to the work of Gould of Philadelphia. It was now known that eyestrain could not be left out of account as a possible cause of most of the functional nerve troubles met with, or at least, as a contributory cause. Attention to this enabled one to indefinitely postpone epileptoid attacks, migrain, recurrent iritis, and perhaps to delay or postpone the appearance of glaucoma and cataract. Eyestrain was more likely to be associated with small rather than large errors of refraction, and, indeed, one-eighth of a diopter might make all the difference between efficiency and unfitness.

He did not agree with those who maintained that cycloplegics were not needed in the estimation of refraction. Most people under 40 years of age were unable to completely relax their accommodation, and this was an obstacle to the observer correctly estimating the real condition of the eye. In all young patients certainly it was very important to paralyze the accommodation. A postcycloplegic examination was also desirable before actually prescribing the glasses. The true situation was expressed by Dr. Hawley of Chicago, when he said that the chief object of using the cycloplegic was to ascertain the exact degree of astigmatism.

In the treatment of myopia the half century had certainly seen an advance. In earlier days, people with no more than 3 diopters of myopia were allowed to do their near work without glasses; but it had since been found that the ideal treatment for myopia was full correction, with, at the same time, correction of any astigmatism which might be present, staying the condition by forcing the ciliary muscle to do its proper work. He agreed with Sir Arthur Keith when he said that myopia was due to a badly constructed sclerotic, that this was prenatal and inherited.

Formerly, presbyopia was very inadequately treated, and it was not thought necessary to correct the astigmatism, unless it was severe. Yet eyestrain, if present, did most harm at the presbyopic age, as the organism then had a lessened vitality and power of recuperation. Bifocal glasses should be prescribed for the condition, especially as they were now so skillfully made. The tendency, however, was to make the reading portion too strong, so that except over a very limited range, objects became blurred. It was very important that the lenses should be correctly centered.

The treatment of imbalance of the extraocular muscles had been placed on a sound basis by Maddox of Bournemouth, and his glass rod test constituted an easy means of diagnosing heterophoria. Small amounts of exophoria and hyperphoria were able to cause as much eyestrain as did small degrees of astigmatism, and the two were often associated. By carefully correcting the refraction, the heterophoria could be gradually removed Excepting in old people or those with a large error, prisms were not the best form of treatment.

The President proceeded to refer to the great value of roentgen rays, radium and ultraviolet light as well as of vaccine therapy having been shown by Goulden and others to be very serviceable in the treatment of tuberculosis of the iris and ciliary body. The importance of a differential blood count in sympathetic ophthalmitis, and the frequent association of dental sepsis with eye trouble were also dealt with.

Much improvement could be registered in the treatment of convergent strabismus in children; when children were brought early, the condition was often curable by glasses alone.

Speaking of the education of the ophthalmologist, Mr. Clarke recommended those commencing this work in an eye hospital to try to put in a year at general practice, the advantages of which he elaborated.

After mentioning a few of the lines along which he hoped to see solid advance in the near future, he said the realization by the ophthalmologist of what his work consisted of provided for him a continual stimulus, and he personally looked to the future of the specialty with a good deal of hope.

HENRY DICKINSON,
Reporter.

American Journal of Ophthalmology

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PARATHYROIDS AND TETANY CATARACT.

Recently the study of the parathyroid glands has thrown light on their function, and the general pathologic effects of their departures from normal. These small glands, associated with the thyroid, began to attract attention when it was found, that their removal with the thyroid in operations for goitre, was rapidly fatal in dogs and cats, and in man, with symptoms of tetany.

Tetany was recognized as a clinical entity, differing from tetanus, almost 100 years ago; and Weiss called attention in 1881 to its occurrence after removal of the thyroid and parathyroid glands. Earlier than that, the history of spasms or convulsions in children and young adults, presenting lamellar or zonular cataracts, was noted by many observers; such history and cataracts being often associated with rachitic disease in early childhood. In 1887 Bouchard and Dor called attention to the production of cataract by ingestion of naphthalin; and naphthalin poisoning is marked by twitching and impaired nutrition quite similar to those of tetany.

Within the last two years, work done in the laboratory of Dr. J. B. Collip at the University of Alberta, has shown that the parathyroids are organs of internal secretion; and that the hormone they furnish has a profound influence on calcium metabolism, and that of other mineral constituents of the body. Injected into dogs, either normal or deprived of their parathyroids, it produces a marked rise in calcium content of the blood and an overdose may be fatal. It can also prevent death and cure the form of tetany due to removal of the parathyroids in dogs. These observations have been confirmed by Prof. Petty and his associates at the University of Pennsylvania.

The chemical composition of the crystalline lens was studied by Burge, both the composition of normal lenses at different ages, and that of large numbers of cataracts. The normal lens showed little change in mineral constituents with age. But cataractous lenses showed diminished potassium, increased sodium, and an increase of calcium in the lens from a trace to 6 or 12 per cent of the lens ash. This abundance of calcium, and in smaller amount silicon, in the cataractous lens, suggests that disorder of the parathyroid internal secretion is worthy of investigation in con-

nection with the causation of cataract. In any case of cataract a history of trismus, or cramps in the extremities, with loss of weight, might be looked for; and Trousseau's sign—spasm caused by pressure on the nerve trunks —should be tested. Meanwhile, laboratory investigations as to the condition of the lenses after prolonged disturbances of function of the parathyroids, might suggest a line along which early cataract would be amenable to treatment, thru system remedies and hygienic influences.

E. J.

FUSION TRAINING.

Binocular fusion generally develops in early childhood, and there is much to support a doubt of its possible development in adult life. But having been once developed and later lost it may be, in some cases, restored by properly chosen exercises, persisted in long enough. After operation correcting strabismus, there are many cases in which no real fusion or true binocular vision can be secured, even by prolonged efforts with various kinds of apparatus. These patients finally desist from trying to fuse their images, and the case is counted a failure for fusion training.

Because they are rare, the oculist is likely to forget the possibility of such results as are reported by Dr. Wolfe in this issue. The fact that success can be attained sometimes, needs to be forced on our attention by such reports. Probably these patients had developed some fusion power in early childhood, which the exercises were able to restore. But the history of the case does not tell if this has been true; and the effort to develop binocular vision, when operation has removed the obstacle to proper divergence or convergence, is the only way to determine whether binocular vision can be brought about. Cases in which it has actually been done after months of effort, at first unsuccessful, are needed to overcome the discouragement arising from the cases in which the patient gives up the trial before securing any benefit.

It would be very unwise to promise such results as an inducement to attempting fusion training. But the possibility of reaching true binocular fusion justifies many attempts, even tho the majority may be unsuccessful.

E. J.

GRADUATE STUDY.

No leader in medicine ever developed his powers in leadership in an undergraduate course of study. Students often think of the medical degree as the goal of their studies. It really means the completion of a preliminary stage, in which the student showed some aptitude for the larger and more important field of study that lies before him. The course has been begun, not finished, when the diploma is granted.

Year by year, this thought is appreciated by more and more of those who have entered the medical profession. Year by year, more seek the opportunities and helps to go forward in their studies; and by new experiments, graduate students and teachers find new and better arrangements to promote such development. As a new step forward the account of the Berlin two weeks course for ophthalmologists, p. 70, is of especial interest.

Much that passes for new in the literature is quotation or echo of earlier writers, and all original observation must be closely connected with what has gone before. In the lectures of such a course the old and new may be brought together in natural relations; and this may be a better form than that of "original" articles, which bring in the knowledge of the fathers to throw light on the new case, or new method, that is the ostensible reason for writing a paper. Collections of papers emanating from one or many medical centers have been popular in various countries. The diffusion and perpetuation in this form of a course of instruction is a promising undertaking; but it will not supersede the individual contact with teachers and

cases, that is now a conscious need of all branches of the medical profession; and in ophthalmology quite as much as in any other.

E. J.

BOOK NOTICES.

Therapeutique Chirurgicale Ophtalmologique, Duverger of Strasburg and **Velter** of Paris. Bound volume, 45 figures in the text and 40 insert plates in colors. Paris. Masson et Cie.

The publications of Masson and Company have been selected with extreme care, and as previously remarked these modern French ophthalmologic publications are very welcome, bringing, as they do, the most recent and best thought into print. This, perhaps, is the most valuable publication of the last decade for the practitioner of ophthalmic surgery.

It is not a treatise, or an encyclopedia. The authors do not try to enumerate, or describe, all of the procedures utilized for ophthalmic surgery. Their field is limited to those which, in their own hands have proven successful, and which have been justified by the results of considerable experience. The authors give reasons for their choice of operation, and point out the postoperative complications for which the operator should be prepared and the precautions to be taken.

Proper anesthesia is very important in ophthalmic surgery. For the reason that the area of operative procedure is limited and the surgery so exact, considerable space is given to the technic of local and regional anesthesia, which with rare exceptions should supplant general anesthesia. Autoplasty of the palpebral conjunctival structure, in particular surgical repair of injuries, is brought well up to date.

Surgery of the cornea, iris and the lens is methodically treated, that of glaucoma in special detail, by reason of the great diversity of the operative indications presented in actual practice, and the importance of skilled technic, especially in chronic hypertension cases. A chapter upon fractures of the orbit and wounds of the sclera follows that on surgical affections of the orbit.

Traumatisms of the eyeball are described in a novel tho practical manner. Previous books have treated this subject from the special anatomic standpoint. But such wounds involve, as a rule, more than one structure, and it is in many cases necessary to consider the lids, eyeball and orbit as a whole. For instance, a fracture of the orbit may involve the frontal, ethmoidal and maxillary sinuses. The spicule of bone may pass thru the orbit penetrating the eyeball, causing separate tho connected injuries to the cornea, ciliary body and lens, all being one accident and practically one wound.

The work is most beautifully illustrated, by 24 colored plates of 6 figures each, 16 of 6 each in black and red, and 45 figures in the text. The illustrations themselves, to those who do not read French, are more than worth the price of the book.

H. V. W.

Die Bestimmung des Astigmatimus durch die Schattenprobe mit Cylindergläsern. Prof. K. Lindner, Head of the Eye Department of the General Polyclinic, Vienna. Cloth, 8 vo., 116 pages, 83 ill., Berlin, S. Karger, 1927.

This is a book by a practical ophthalmologist, who knows enough of optics and mathematics to understand the scientific side of the shadow test. But Lindner also knows, that most of his colleagues in ophthalmic practice are not working daily with mathematical formulas; and that skiascopy has a practical value so great, that it should be mastered by every ophthalmologist who undertakes to prescribe glasses.

In the textbooks on ophthalmology and refraction there are so many passing allusions to skiascopy and statements of rule of thumb ways to use it, that many of their readers fall into grave error of thinking they know all that is necessary about this test. This does not lessen the need for papers, that will help the working ophthal-

mologist to understand the best forms of the shadow test and impress the need to use them. Altho he had described it in the transactions of the meeting in 1918, Lindner demonstrated his method of skiascopy with cylinders, before the German Ophthalmological Congress at Heidelberg in 1925; and the paper read the same month, by O'Brien at the Colorado Congress, was published in this JOURNAL, (v. 9, p. 107).

In neither meeting was there discussion evincing an understanding or an interest commensurate with the practical importance of the subject. A book on skiascopy with cylinders or a translation of this one might be published in English, since the accounts of it are generally scattered in articles appearing in various journals. The shadow test with cylindrical lenses is not a thing apart from skiascopy in general; but rather the culmination and full development of skiascopy.

After an introduction on the historic development of the shadow test which notices the work done in America in this direction, Lindner explains the procedures for skiascopy in general, with the usual methods and apparatus. Then he takes up the technic of the shadow test, and the illumination in different states of refraction, and the conditions that determine rapidity and distinctness of light movement. These are points that receive little if any attention in many of the descriptions of the shadow test. The total aberration of the eye, often ignored in descriptions of skiascopy, is here adequately considered. Its enormous practical importance more than justifies the five pages and four illustrations, here given to it.

The skiascopic phenomenon of astigmatism introduces the shadow test with cylindrical lenses, both as to its common appearances and its theoretic foundation. Examples are then given of the correction of hyperopic astigmatism with convex cylinders, under homatropin cycloplegia, and its correction with concave cylinders. There is a general review of working methods and a collection of rules to be followed. The cylinder test and irregular astigmatism are then considered, and a subjective testing with the glasses fixed on by skiascopy is urged. The accuracy of skiascopy with cylindrical lenses is discussed, and the sources of possible error are also pointed out.

That so valuable a book could be rewritten on this somewhat hackneyed subject, may be a matter of surprise to some readers, but it will not surprise those who have learned the importance of this phase of skiascopy, thru their own practical experience. The illustrations that elucidate the theory of skiascopy, represent by different colors the different pencils of rays. These make it much easier to grasp the relations and modifications of these pencils, as they pass to and from the retina. The half-tone representations of the varied appearances of light and shadow in the pupil are particularly accurate and satisfactory.

For ready reference an alphabetic reference would be a great help. As it is not given, the table of contents is the only aid to tracing the place in the book that a certain thing is discussed. It is hoped, now that a book has been published in German by an eminent Vienna professor on this one aspect of skiascopy, that it may encourage ophthalmologists thruout the word to master it more completely than they have commonly done.

E. J.

Rhinogene Neuritis Retrobulbaris. **Prof. J. Meller** and **Dr. Oscar Hirsch,** University of Vienna. Paper, 8 vo. 64 pages, 2 colored plates and 4 illustrations in the text. Berlin, S. Karger, 1926.

This treatise consists of two parts, one of the ophthalmologic portion, 24 pages, by Professor Meller, head of the I Eye Clinic of the University of Vienna; the other rhinologic, 40 pages, by Privat Docent Dr. Hirsch, of the University of Vienna. The 9 illustrations belong to the second part, showing the relations of the nasal and paranasal structures and sinuses.

Without any formal review or bibliography of it, the literature referring

to rhinogenous retrobulbar neuritis has been drawn upon, to furnish a unified and fairly complete picture of this subject, from the different aspects it presents to ophthalmologist and rhinologist; and a few abstracts of illustrative cases are included from the clinical experience of Prof. Meller.

Therapeutic measures are referred to, from the influence of cocainization to free bleeding from the nasal tissues; and the operative eradication of concealed foci of infection in the ethmoid. Cases of rapid improvement in the vision after intranasal treatment are referred to; and in the rhinologic part the conditions likely to conceal the ethmoidal condition are pointed out.

Both for those who confine their practice to conditions of the eyeball and orbit, and for those interested chiefly in the nasal conditions, it is well to have the two independent views of this clinical entity placed side by side. The condition can only be understood by recognizing that both sides are real and essential, and that each takes practical importance from its association with the other.

E. J.

Berliner Fortbildungskurs für Augenärzte. Edited by **Dr. A. Rosenberg.** Paper 8 vo. 235 pages, 23 illustrations and an insert table. Berlin, S. Karger, 1926.

In October, 1925, an advanced course for ophthalmologists was given at Berlin. It extended two weeks and included 30 lectures, which have been published under the editorship of Dr. Rosenberg. Of the lectures here published 21 were given by residents of Berlin, and 5 by teachers from other cities. A lecture on the visual paths and centers was given by Lenz; and one on diagnosis and treatment of palsies of the ocular muscles were given by Bielschowsky, both of Breslau. Erggelet, of Jena, gave one on spectacles; and Greeff of Berlin one on the basis of prescribing glasses. Behr, of Hamburg, took up the treatment of tabetic optic nerve atrophy; and Meisner of Griefswald the specific treatment of ocular tuberculosis.

There are also lectures by Hofmann on the space sense, and by Kolrausch on color testing. Referring to glaucoma are lectures by Meesmann, Thiel and Krückmann. Comberg lectured on Roentgen diagnosis, and on radiotherapy and injury of the eyes. Other lectures on therapeutics were given by Lewin, Joachimoglu, Kuffler, Blumenthal, Krückmann and Saalfeld. Under the heading clinical ophthalmology Krückmann took up the diagnosis and prognostic significance of hemorrhage in the fundus; Paderstein swimming bath conjunctivitis; and Wätzold gave demonstrations of pathologic anatomy of the eyes. There were 9 lectures on the relations of general diseases to the eyes; to internal secretions by Brugsch, renal pathology by Munk, pregnancy by Adam, the eyes and nervous diseases by Creutzfeld, the exudative diathesis and avitaminosis by Opitz, the relations of eye and orbit with neighboring cavities by Seifert, heredity and eye diseases by Czellitzer, and advice about eye diseases by Wätzold.

This long list indicates the breadth of the subjects taken up, the number about which there was new matter to present, the necessity for such graduate study on the part of every one who desires to keep abreast of the advances in ophthalmology. In addition, Comberg and Meesmann each gave slit lamp demonstrations, filling eight two-hour periods. Operations were also demonstrated in three clinics by Fehr, Silex and Müsham. To isolated workers in ophthalmology such a course must have been interesting and inspiring. The printed account of it makes it possible to spread its influence more widely; and, for those who heard the lectures, to review the course and thus profit still further from it. Such a publication entails much labor and financially may not repay its cost, but both teachers and pupils will derive great benefit from it.

E. J.

Our Own and Our Cousins' Eyes. **Thomas Hall Shastid**, A.M., M.D., F.A.C.S., LL.D. Duluth, Minn. Cloth. octavo, 32 pages. American Optical Company, Southbridge, Mass. 1926.

This is a reprint of a lecture delivered at the Mayo Clinic, and first pub-

lished in the American Journal of Physiologic Optics in April last. It is "an attempt to exhibit the evolution of the eye, so far as possible, in language free from technicalities." The oculist is often expected to know something about the eyes of lower animals; or, in a company familiar with the facts of evolution, to know something of the processes of evolution manifested in the eye. This book, within the limitations of its small size, gives an excellent account of various forms of eyes, by discussing some of their typical forms, grouped according to the history of their evolution.

An idea of its scope is given by some of the headings which appear on its pages, which are: The eyes of the common ancestor; The first specialized eye; the eye pit; the ancestor of the two humors, the first cornea, the first lenses, and the eyes of insects. Then, with the eyes of fishes, are considered, retinal rest, the beginnings of eyelids, fishes' eyes and depth of water, blind cave dwellers and red light, the eyes of typical fish and the first irides and pupils. Next come the eye of amphibians, an eye in the back of the head, the eyes of reptiles, the eyes of mammals, the pupils of mammalian eyes, the membrana nicitans in mammals, the fundus in mammals and the peculiarities of horses' eyes.

The eyes of primates—monkeys, apes and men—develop binocular vision, and new subjects are considered as "dominancy and serviency in eyes." Then come the eyes of birds, "infulae and accessory maculae in human eyes." Finally Dr. Shastid sketches "what is going on in human eyes now," and indulges in speculation about the human eye hereafter.

A complete presentation of this subject would require a double encyclopedia, on ophthalmology and evolution. But in this small brochure Dr. Shastid gives, in language that makes it fascinating, an outline on which a more complete study might be undertaken in books that most students procure. It is a suggestion of a side line in thought, that many an ophthalmologist would find interesting and improving. E. J.

Transactions of the College of Physicians of Philadelphia. Third Series, Vol. 47. Edited by **Walter G. Elmer,** M.D. 1925. Cloth, octavo, 908 pages. Illustrated. Published by the College, Philadelphia, 1926.

However specialized one's practice may become he should still keep in touch with the general thought and advances in medicine. The literature is open to him in general medical books and journals; but the easiest way to keep this nourishing contact is thru medical societies. The Transactions of the College of Physicians of Philadelphia combines the advantages of literature and account of meetings that are broadly educational.

Among the subjects of broadly educational papers are: The Socalled Reticular-endothelial System" and its functions. "The Effect of Various Agents on the Enzymes of the Blood and Skin." Among these ultraviolet light has first place. "The Internal Secretion of the Parathyroid Glands" which seems to have a profound influence on calcium metabolism. In view of the association of parathyroid activity with tetany and cataract the last subject possesses especial interest for the ophthalmologist. A similar interest may be found in the paper and discussion on "The Glandular Treatment of Pituitary Tumors and Hyperplasias," in which occasional excellent results were reported.

The portion of the volume having the greatest ophthalmic interest is that which reports the proceedings of the Section on Ophthalmology. But these Proceedings have already been published in this JOURNAL; some papers published in full that appear here only in abstract. Much general interest also attaches to the lectures here published on "The Relation of Mechanical and Electrical Phenomena of Muscular Contraction," "The Nature and Mode of Regulation of Glomerular Function." "The Surgical Treatment of Pulmonary Tuberculosis," and "The Advancement of Epidemiology Thru Experiment."

To the reader interested in medical history and of Philadelphia institutions

there is much of special appeal in this volume; but the contributions it contains to science and practical medicine justifies a wide interest in its contents.

E. J.

Report of the Commissioner of Health of Porto Rico, 1925. Pedro N. Oirtz, M.D. Paper, 8 vo., 184 pages, illustrated. San Juan, P.R., Bureau of Printing, 1926.

This report deals largely with the control of malaria and hookworm disease. On the Staff of the Department we notice the superintendents of the Blind Asylum of the Institute for Blind Children. Apparently the Blind Asylum is a hospital for the treatment of eye diseases. Of the 233 patients, 188 are set down as curable and 45 as incurable. Of the 75 operations performed, 57 were for cataract, 8 for pterygium and 3 enucleations. There were no lid operations and trachoma does not seem to claim attention. The report, like others of its class, is largely occupied with statistics. The illustrations are of buildings and grounds, plans of health districts and charts of statistics.

E. J.

Legalized Optometry and the Memoirs of Its Founder—Charles F. Prentice, M.E., New York. Memorial Edition—Limited to 200 copies. Seattle, Casperin Fletcher Press. See also p. 853, v. 9.

The scientific writings, experience and standing of the author gives him a right to express opinions, as one who has endeavored to raise the standing of the opticians of this country to a position approaching that of a profession. The book is polemical and controversial, taking a stand between that of the medical profession and that of the prescribing optician. It narrates the history of optometry legislation in the United States, giving authentic information respecting the fundamental principles upon which the present legalized practice is founded.

We ophthalmologists cannot agree that the practice of measuring the ocular refraction and of prescribing lenses for the betterment of sight, is a "purely drugless" method of correcting optical defects. We know that a very large proportion of people who really need glasses for the correction of their errors of refraction have at the same time some local, or organic disease, or anomaly. The diagnosis and recommendation of treatment, therefore can only be made by a man fully educated as a physician.

Be this as it may, the book is of interest to the physician as he will be amusingly entertained by the acrimonious arguments entailed in the so-called conflict between the opticians and the oculists. The incipient stages of legislation appeared in New York in 1895; and since that time there has sprung up a horde of optometrists and ophthalmometricians, prescribing opticians and jewelers, who have been more or less legislated into somewhat of a professional standing in various states of the Union. We physicians have been altruistic in economic and legislative problems, have not, to my knowledge, opposed the various laws and regulations and the legalizing of the various cults, including those relating to prescription and dispensing of glasses, have not found that these kinds of people interfere with the legitimate practice of medicine. Our interests have been entirely for the individual patient; and anyone needing glasses is a patient needing the services of a physician rather than that of an artizan. Therefore, under the "mere qualification of the medicine degree," we do not use it as a pretext to dictate to opticians; we do desire, however, and insist that the simple ability to measure the eye does not qualify a person to be dignified by the title of Doctor. We wish to cooperate with the legitimate opticians, who know that they are not capable of advising a person who comes under the class of a patient. The author of the book has had much controversy both with oculists and with his fellow opticians. He acknowledges in page after page that the refraction of the eye can only be fully measured by suspension of the accommodation with cycloplegics, that the instillation of mydriatics or other medicaments in the eye should be under the advice of a physician. About

half the book is given over to these controversial matters.

In the latter portion of the book, besides the story of his professional life and his relations to his oculist and optical acquaintances, he gives his advanced views upon political and legislative matters, paying some attention to the 18th amendment, and gives advise to the venturesome critics on his other writings and of this book.

We are indebted to authors of this type for an insight into the working of mens' minds, some of whom, like the author, have given much study to physiologic optics and have advanced the study of the subject.

The book is restricted to two hundred copies, paid for by the author and distributed by him, complimentary to friends and acquaintances.

H. V. W.

ABSTRACT DEPARTMENT

Reprints and journal articles to be abstracted should be sent to Dr. Lawrence T. Post, 520 Metropolitan Building, St. Louis, Mo. Only important papers will be used in this department, others of interest will be noticed in the Ophthalmic Year Book.

Roger, Reboul, Lachaux and Bonnal. Bilateral Exophthalmos with Bilateral Paralysis of the External Recti. Com. Méd. des Bouches-du-Rhone, 1926, May. Abst. Gaz. des Hôp., 1926, v. 99, p. 1003.

The condition had lasted 6 months, and was accompanied by a progressive loss of sight. In the absence of any other lesions or symptoms, the authors considered it to be a case of bilateral tumor of the orbit. C. L.

LoCascio, G. Nephritic Neuroretinitis. (10 pl. bibl.) Ann. di Ottal. 1926, v. 54, pp. 3-64 and 129-219.

LoCascio's monograph of about 140 pages with regard to the clinical and anatomic aspects of nephritic neuroretinitis is profusely illustrated and is accompanied by an extensive bibliography. His conclusions are too voluminous to be given in detail, but the following are perhaps of more particular interest: The author recognizes only two clinical forms of nephritic neuroretinitis, (a) the classical form, characterized by the presence of white spots and of scattered hemorrhages in the posterior region of the fundus, and (b) a circinate form in which the white spots present a special circular disposition around the macular region. In the majority of eyeballs with nephritic neuroretinitis, histologic examination reveals the presence of the alterations in the choroid, involving the vessels or the stroma. The vascular changes are more diffuse in the arteries than in the veins, and the arteries most involved are the small ones in the peripapillary zone. The retinal changes are most prevalent in the strictly nervous layers, the pigment layers usually preserving the normal appearance. The principal changes in the retina are found in the plexiform layer of the external reticular layer, and consist of (a) simple edema, (b) the presence of delicate fibrinous networks, (c) the presence of cystoid spaces, either empty or containing fibrinous networks, (d) the presence of masses of hyalin, granular, or reticular character, (e) the presence of special vesicular and fusiform elements, (f) hemorrhagic infiltrates in various stages of involution. Hemorrhages are almost constantly found within the retina, principally in the external plexiform but sometimes also in the more internal layers. The principal and more constant retinal changes are the expression of a vascular exudation. In general the process is an inflammatory one, which is only in rare cases followed by a degenerative form. Anatomically, the grayish white color of the retina around the optic disc and along the vessels is a manifestation of retinal edema which is particularly accentuated in these localities. The milky white color sometimes found in the retina is due

to the presence of a more or less dense layer of a substance found histologically to be of hyalin character, and which, interposed between the pigment epithelium and the layer of rods and cones, slightly elevates the retina. The white spots of varying form and size, found ophthalmoscopically, are not due to foci of gangliform degeneration of the nerve fibers, nor to accumulation of lipoid substances, but to the presence in the external plexiform layers, and also frequently in the granular layers of hyalin, granular or reticular material, or the remains of fibrin or hemorrhage. The anatomic basis of the star figure in the macular region is the presence of small oblong masses, hyalin or reticular, which instead of being disposed perpendicularly to the surface of the retina, as in other retinal areas, have an oblique position due to the special arrangement of the fibers of the external plexiform layer in the macular region. The author considers that in nephritis with retinitis there are produced in the walls of the retinal and choroidal vessels, changes which the microscope does not disclose, but which modify the permeability of the vascular walls so as to allow exudation and the formation of hemorrhages.

W. H. C.

Steyn, J. S. Familial Juvenile Degeneration of Macula. Brit. Jour. Ophth., 1926, July, v. 10. One ill.

The writer pointed out that tho the clinical features and the ophthalmoscopic changes differ somewhat from those seen in the Warren Tay-Sachs disease, yet the pathologic changes of the central nervous system, and the ganglion cells of the retina are so similar, that it seems probable that they are one and the same disease, but occurring at somewhat different periods of life. The children are born healthy and develop normally to a period of life varying with the different families. They begin to show, first, loss of intellectual faculties; then, loss of vision; and lastly, loss of motor power. The disease progresses slowly, eventually rendering the child blind, demented, and spastic. The disease is neither race nor sex selective. The changes at the macula consist of a diffuse pigmentation which extends more or less into the neighboring retina. The disc is of a greyish white color with vessels a little thinner than normal.

Three case histories, two in men aged 28 and 21 years respectively and one in a girl aged 13 years are detailed.

D. F. H.

NEWS ITEMS

Personals and items of interest should be sent to Dr. Melville Black, 424 Metropolitan Building, Denver, Colorado. They should be sent in by the 25th of the month. The following gentlemen have consented to supply news from their respective sections: Dr. H. Alexander Brown, San Francisco; Dr. Wm. Thornwall Davis, Washington; Dr. Gaylord C. Hall, Louisville, Ky.; Dr. J. W. Kimberlin, Kansas City, Mo.; Dr. George H. Kress, Los Angeles; Dr. Edward D. LeCompte, Salt Lake City; Dr. W. H. Lowell, Boston; Dr. G. Oram Ring, Philadelphia; Dr. Charles P. Small, Chicago; Dr. G. McD. VanPoole, Honolulu.

DEATHS.

Dr. James Wilford Good, Vancouver, B. C., Canada; age seventy-four years, died September first.

Dr. Francis Miles Chisolm, Washington, D. C.; age fifty-nine years, died September twenty-one, at Edgewater.

Dr. Charles M. Robertson, Waukegan, Ill.; age sixty-one years, died October thirty-one, of peritonitis following an appendectomy.

SOCIETIES.

The first regular meeting of the season of the Ophthalmological and Otolaryngolgical Section of the Cleveland Academy of Medicine was held at Hotel Winton, Friday evening, October twenty-ninth. The meeting was well attended and proved not only instructive but interesting as well. The program consisted of a symposium on the subject of the "Larynx."

At a meeting of the Section of Ophthalmology, College of Physicians of Philadelphia, Thursday, November eighteenth, the following program was given: Dr. Wm. Zentmayer: "Exhibition of a Case of Tumor of the Iris;" Dr. Chas. R. Heed: "A Case of Traumatic Enophthalmos;" Dr. Louis Lehrfeld, by invitation: "A Case of Sarcoid of the Eyelid;" Dr. S. S. Greenbaum, by

invitation: "A Case of Epithelioma of the Eyelid;" Dr. Luther C. Peter: "Observations on the Surgical Treatment of Cataract Complicated with Glaucoma;" and Dr. Wm. F. Bonner, by invitation: "Ocular Fields in Syphilis: Retinochoroiditis in Early Tabes." Presentation of Case.

A meeting of unusual interest was held by the Chicago Ophthalmological Society on November fifteenth, at the Illinois Eye and Ear Infirmary. The Staff of the institution, drawing upon the wealth of clinical material,, presented over one hundred carefully selected cases manifesting both external and internal eye lesions. Three large Gullstrand Binocular Ophthalmoscopes and three slit lamps were used in the demonstration. A special feature of the program was a demonstration of the Nordenson Zeiss Fundus Camera, and patients whose fundi has been previously photographed were presented for comparison of the photographs with the lesions as seen with the ophthalmoscope. The instructive value of such clinical meetings was generally attested by the many ophthalmologists present. Other such meetings will be arranged in the future, to which wider publicity will be given.

PERSONALS.

A postal has been received from Dr. G. M. VanPoole, of Honolulu, who is sojourning in Vienna for the winter.

Dr. John Green has been unanimously elected as First Vice-President of the St. Louis Medical Society, for 1927.

Dr. William D. Rowland of Boston has been made professor of ophthalmology of the Boston University School of Medicine and Dr. Albert W. Horr becomes the emeritus professor of ophthalmology.

Dr. Edward Jackson is giving a series of lectures to the members of the Colorado Ophthalmological Society on Physiologic Optics. This society meets in Denver on the third Saturday evening of each winter month. Dr. Jackson will deliver his lectures at four thirty each Saturday afternoon preceding the meeting.

Cleveland ophthalmologists who were fortunate in participating in Prof. Imre's recent course on the surgery of the eye were Drs. W. E. Bruner, A. B. Bruner, R. E. Metz, W. P. Chamberlain, J. H. Ralston, W. J. Abbott, M. P. Motto and Myron Metzenbaum. Following the completion of the course, Prof. Imre was the guest of honor at a dinner given by the class at the University Club.

MISCELLANEOUS.

The Brooklyn Industrial Home for the Blind was left $500 by the will of Isidor Waschauser.

Under the will of the late Mrs. Annie C. Kane, the New York Eye and Ear Infirmary was left $25,000.

A booklet has been received from Dr. Thomas Hall Shastid of Duluth, entitled "Our Own and Our Cousins' Eyes." This little book presents the subject of eye evolution in very lucid form. It also presents the author's view on what he believes to be the evolutionary end result of human eyes; namely, the "one, large, central, Cylopean eye." Dr. Shastid is the author of "The Duke of Duluth," "Simon of Cyrene," and "Who Shall Command Thy Heart."

The Massachutts Eye and Ear Infirmary celebrated its one hundredth anniversary at a dinner given at the Algonquin Club on November fourth. The guests of honor included the Governor and Lieutenant Governor of the state of Massachutts, the President of Harvard University, Dr. Lucien Howe of Buffalo and Dr. George E. de Schweinitz, Philadelphia. The infirmary is conducting a million and a half dollar campaign. The infirmary receives no support from the state and its present income is insufficient to meet the needs.

In the eleventh annual report of the National Committee for the Prevention of Blindness, it is stated that during the year, twenty-nine sight saving classes for public school children were established, making the total now two hundred in the United States. The committee distributed during the year, without charge, almost a half a million books, bulletins, folders, posters, and so forth, dealing with the prevention of blindness; and thru lectures, motion pictures, convention exhibits and radio, brought to the attention of a multitude of other persons methods of safeguarding sight.

An excellent postgraduate course on the surgery of the eye, including lid plastics, was recently given in Cleveland, Ohio, by Joseph Imre, professor of ophthalmology at the University of Pecs, Hungary. The course consumed two weeks, three hours daily being given to lectures, demonstrations and practical work on the cadaver and pigs' eyes. From the ophthalmic services of Drs. Wm. Evans Bruner and R. B. Metz, at Lakeside Hospital, the operative cases were taken. Prof. Imre was thus able to demonstrate his technic in cataract and lid plastic operations. Thru the courtesy of T. Wingate Todd, professor of anatomy at the School of Medicine of Western Reserve University, sufficient cadavers and excellent accommodations were extended the class. While the course proved quite strenuous, it was highly valuable and instructive. It is regretted that Prof. Irme's stay in the United States is so brief, as his lecture course would be greatly appreciated in all major cities of this country.

Current Literature

These are the titles of papers bearing on ophthalmology. They are given in English, some modified to indicate more clearly their subjects. They are grouped under appropriate heads, and in each group arranged alphabetically, usually by the author's name in *heavy-faced type*. The abbreviations mean: (Ill.) illustrated; (Pl.) plates; (Col. Pl.) colored plates. Abst. shows it is an abstract of the original article. (Bibl.) means bibliography and (Dis.) discussion published with a paper.

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Guist, G. Considerations cliniques et resultats experimentaux sur la faculté de reparation de la retina apres interruption de la circulation sanguine. 124 pages 2 fig 2 col. pl. S. Karger, Berlin 1926. A. J. O., 1926, v. 9, p. 553.

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Fox, L. W. Clinical observations with slit lamp. Brit. Jour. Ophth. 1926, v. 10, pp. 592-596.

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Pascal, J. I. Ocular dominance and chromatic test. Amer. Jour. Optom. 1926, v. 3, p. 370.

Robinson, W. V. Ophthalmoscope in general practice. Clinical Jour. v. 55, 1926, pp. 497 and 512. Continued.

Salzer. Principles of perimetry. Klin. M. f. Augenh., 1926, v. 77, p. 574.

Thomasson, A. H. Simplified tangent screen suggestions on field taking. Arch. of Ophth., 1926, v. 55, pp. 845-854.

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Alajoo. Influence of instillation of morphin and its derivatives on normal eye. Studies with slit lamp. Clin. Opht., 1926, v. 30, p. 591.

Bakry, M. M. Idiosyncrasy to iodin. Ophth. Soc. Egypt, 1926, pp. 80-82.

Beckershaus, F. Experience with goldsol reaction. (Bibl.) Zeit. f. Augenh. 1926, v. 60, pp. 125-133.

Cecchetto, E. Iontherapy. (ill.) Ann. di Ottal. e Clin. Ocul. 1926, v. 54, p. 1227.

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Kuriks, O. Bactericidal efficacy of collargol in ocular diseases. (3 ill. Bibl.) Klin. M. f. Augenh., 1926, v. 77, pp. 470-487.

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Maillard. Atophanyl and cyclotropin in ophthalmology. Münch. med. Woch. 1926, v. 73, p. 1843.

Szokolik, E. Subconjunctival atropin-adrenalin injection. Zeit. f. Augenh. 1926, v. 60, p. 231.

Wick, W. Irritant therapy in ocular diseases. (3 ill.) Klin. M. f. Augenh. 1926, v. 77, pp. 487-497.

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Schall, E. Ichthyol salve after ocular operations. Zeit. f. Augenh., 1926, v. 60, pp. 190-192.

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Morris, C. W. Oculomotor reflexes in visual perception. Amer. Jour. Physiol. Optics, 1926, Oct., pp. 523-542.

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Fincham, E. F. Changes in form of crystalline lens in accommodation. Amer. Jour. Physiol. Optics, 1926, Oct., pp. 469-522.

Hutchinson, E. A. Cyclophoria and oblique astigmia. Amer. Jour. Physiol. Optics, 1926, Oct., pp. 639-643.

Ketchum, W. Dynamic skiametry. Amer. Jour. Physiol. Optics, 1926, Oct., pp. 543-547.

Krämer, R. Skiascopy with cylinders. (6 ill.) Zeit. f. Augenh., 1926, v. 60, pp. 172-189.

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Menestrina, G. Corneal astigmatism and ametropia. (8 tables, Bibl.) Arch. di Ottal. 1926, v. 33, pp. 399-438.

Meyerbach, F. Müller's contact glasses Klin. M. f. Augenh., 1926, v. 77, pp. 507-511.

Sheard, C. Neutralization, effective power and vertex refraction of cataract lens. Amer. Jour. Physiol. Optics, 1926, Oct., pp. 548-557.

Singer, J. Changes in refraction in diabetes. Zeit. f. Augenh., 1926, v. 60, p. 234.

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Cords, R. Unilateral nystagmus. Klin. M. f. Augenh., 1926, v. 77, p. 572.

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Kreiker, A. Gold chlorid staining of albinism of tarsal conjunctiva. Zeit. f. Augenh., 1926, v. 60, p. 231.

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